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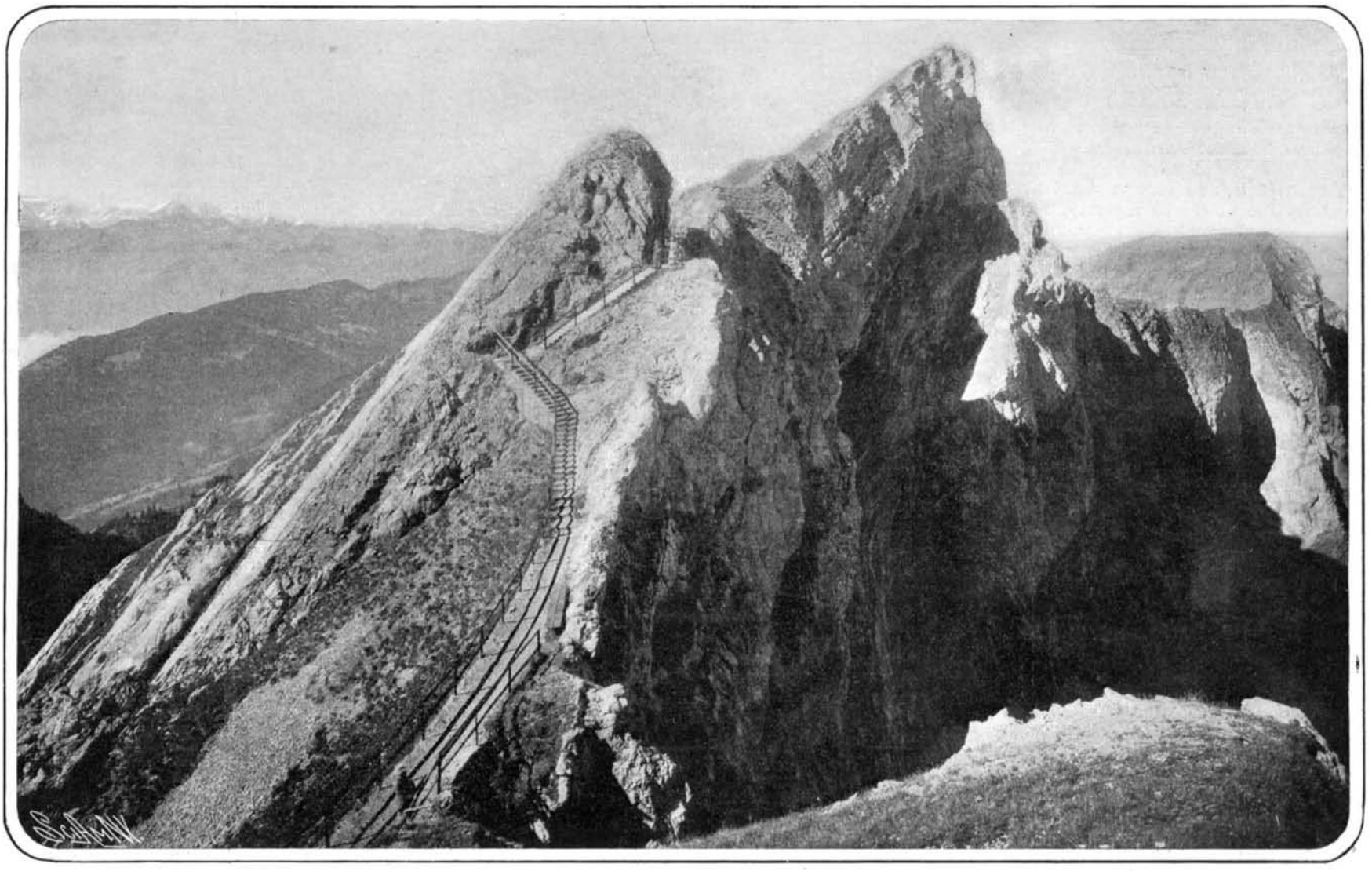
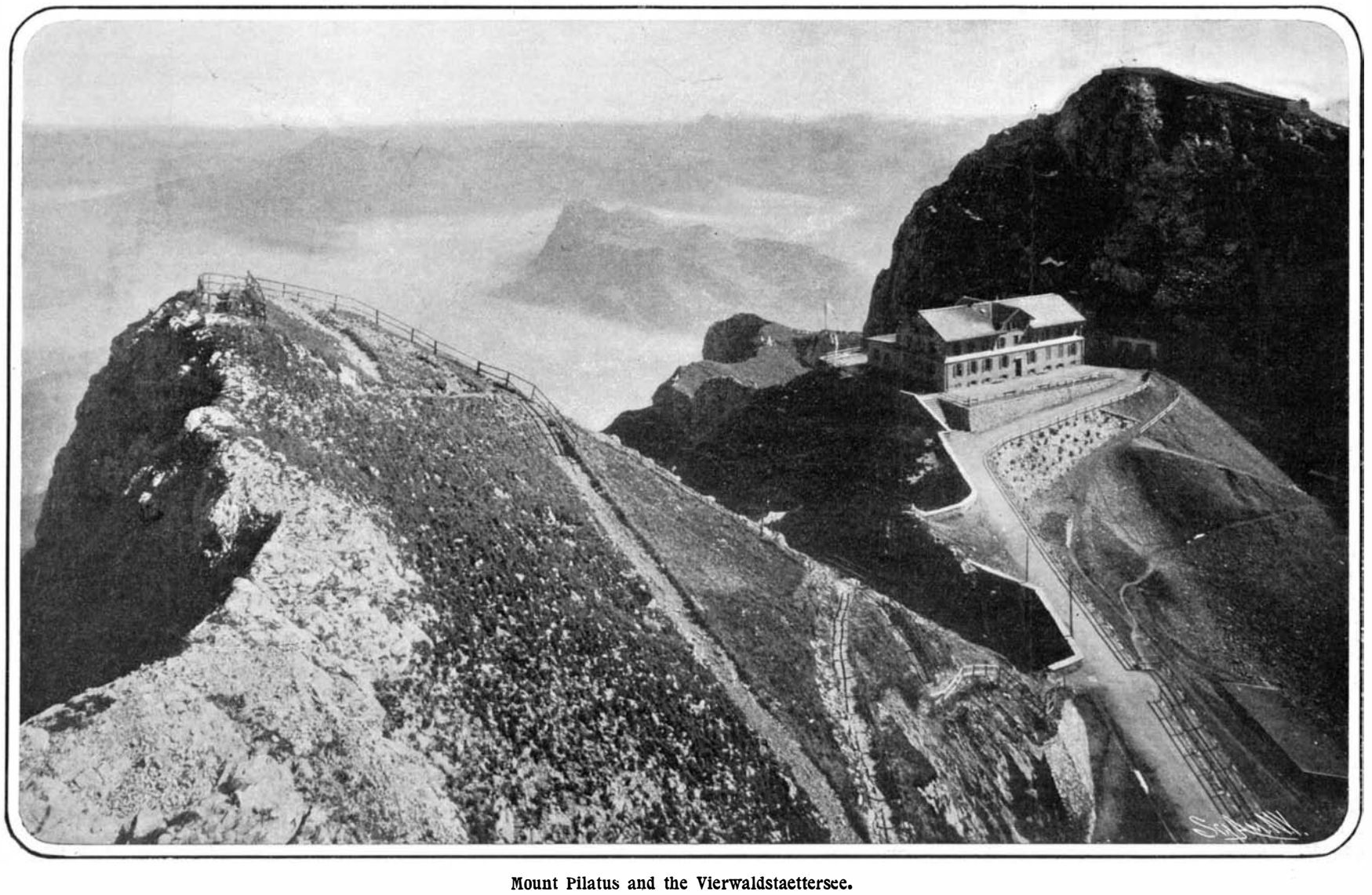
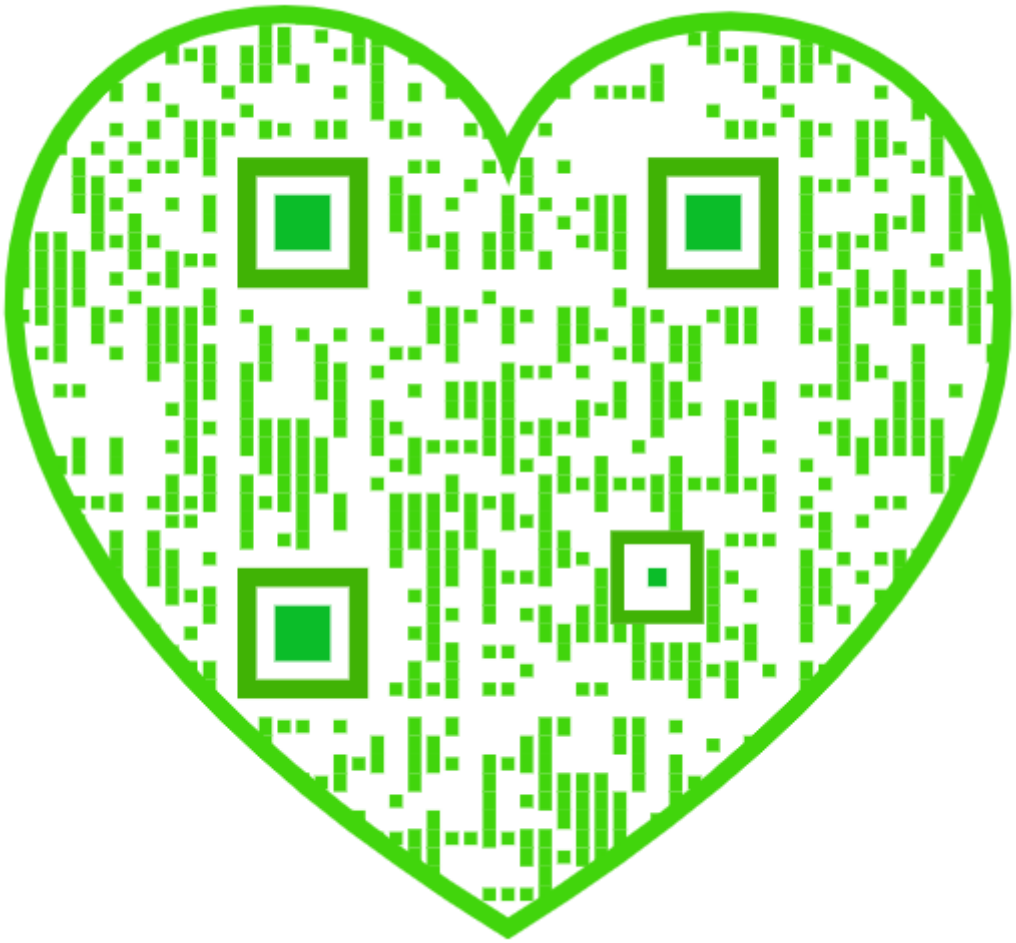


The Tomlishorn, 6,996 Feet High—A Noble Peak in the Alps.



Mount Pilatus and the Vierwaldstaettersee.

THE MOUNT PILATUS RAILWAY, SWITZERLAND.—[See page 110.]



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NEW YORK, SATURDAY, AUGUST 13, 1904.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

FOUR LEADING FOREIGN EXHIBITS AT THE WORLD'S FAIR.

In any comparison, no matter upon what it may be based of the display made by the various nations at the St. Louis Exposition, the magnificent exhibit made by Germany easily takes the place of honor. At the same time, when we remember that the effort of Japan was made under the shadow of an ominous war-cloud, that foretold for that gallant nation a life-and-death struggle, there will be many to whom it will seem that the scarcely less varied and voluminous exhibit of that wonderful race is entitled to equal if not greater consideration. The world has heard very much of late years about the remarkable advance that Germany has made in practically every branch of the arts and sciences. To-day we have the record of that advancement spread out before us at St. Louis, in concrete form. The display is arranged on an orderly plan so well conceived and carried out that not only is the greatness of Germany thrust upon one at the very first glance, but the story is told in marvelous detail and with most fascinating and picturesque effect throughout all the great buildings of the Exposition.

Germany.

It is not too much to say that to the Emperor William himself is to be attributed, more than to any other agency, both the breadth and detail of this exhibit. The Germans themselves readily and affectionately admit this. In the first place it was he who conceived the happy idea of placing the executive offices of the German Commission in a large separate building, which should be an exact reproduction to scale of a considerable portion of the Royal Castle of Charlottenberg. Had Germany done nothing more than this, she would have been well represented; for the castle itself is filled with some rare and characteristic specimens of German art, and is enriched by much of the actual furniture and furnishings brought over from the royal residence for exhibition in this building. A distinct advance has been made over previous expositions by placing the architectural features (in the way of inclosures and inside pavilions for the aggregate exhibits in separate buildings) in the hands of an architectural commission, and the work that they have done is not only highly meritorious and becoming, but it bears the broad stamp of modern German art and serves at once to collect and unify in the eye and mind of the visitor the various separated elements in the German display. Another striking feature, resulting from the orderly and discriminating plan on which the exhibit has been laid out, is that there is a most refreshing absence of the ordinary and commonplace—what might be called the stock or shop-window order of display. Everything is of the very best and most distinctive. Moreover the exhibits have been chosen with a view to illustrating those particular phases of German industrial and artistic development which are most characteristic of the Germany of to-day. This is true of the superb exhibit of German arts and crafts in the Varied Industries Building; of the extraordinary rich and elaborate scientific and technical apparatus in the Educational Building; of the large collection of apparatus for the testing of foods and for laboratory research in the Agricultural Building; and of the more limited display in the Machinery and Transportation Buildings. Any thoughtful student of what Germany has done at St. Louis will, after making the tour of her exhibits, be well able to understand the secret of the marvelous growth that that country has made during the past three decades in the worlds of art, industry, and commerce.

Japan.

Next in order of merit comes the extensive display made by that other great industrial country—Japan. It is rendered the more remarkable by the fact that it was cheerfully undertaken and carried through, first under the shadow, and now under the actual stress, of one of the greatest wars in history. The commercial and industrial rise and progress of Japan, like that of Germany, is a story that loses none of its interest in the telling. What the student has learned from government statistics, from magazine and newspaper literature, and from books of travel devoted especially to the theme, he may here behold spread out before him in picturesque profusion, both in the charming Japanese garden where the Commission makes its home, and in the many acres of space which Japan requested, and promptly filled up with the products of the Island Empire. That Oriental Garden with its picturesque pavilions, its tiny lakes and waterfalls, its grottoes, its miniature trees and characteristic shrubberies, its quaint statuary, to say nothing of its tea houses where the westerner may drink Japanese tea handed to him by Japanese girls in their picturesque attire, was bound to become one of the choicest and most popular resorts of the fair. Here one may meet the chief commissioner, who with characteristic Japanese courtesy will give a brief summary of what Japan has aimed to do in bringing over 500 native Japanese to care for and exploit the $1,500,000 worth of display which tells of Japanese industrial life and commercial greatness.

And, by the way, there is a remarkable parallel in many respects between the two great nations that have given such distinction to the St. Louis Fair. The Japanese exhibit, like that of Germany, is distinguished by its comprehensive and orderly arrangement. Come upon it when you may, it is surrounded by distinctive Japanese architecture, not indeed so distinctive or elaborately carried out as that of Germany, but still sufficiently defined to render a Japanese exhibit recognizable at first sight. Then, moreover, the exhibits are arranged evidently with a view to producing a definite educational result upon the visitor. In whatever department of industry one may happen to find himself, the exhibit almost invariably commences with the raw material and carries the interested observer up through the successive stages until the finished product is reached.

It is impossible to go into details; but mention should be made of the exhibit in the Agricultural Building, which is devoted chiefly to the great tea industry of Japan; also of the very extensive display in the Transportation Building, showing the remarkable development in the past three decades that Japan has made of postal, railway, telegraph, and steamship enterprises. Here one may see a huge relief map, 100 feet in length by 50 in width, showing the whole Japanese empire, including Formosa, and indicating by various colored lines every mile of railroad track, and telegraph or telephone wires, and the routes traversed by the great steamship companies. In the Varied Industries Building is a bewildering display of all that is rich, rare, grotesque, or beautiful in Japanese art. Bronzes, porcelains, silk embroideries, richly-chased and engraved silver and gold work, characteristic carving on wood and ivory, enamel work on silver, gold, and bronze, and a thousand dainty objects of the kind that are dear to the heart of the connoisseur. Lastly, there is the instructive display in the Palace of Manufactures, where one may learn everything about the manufacture of silk goods in the Island Empire, from the hatching of the silkworm eggs up to the weaving of the silk into the finished fabric; while adjoining it is a splendid display of Japanese matting, 600 rolls in all, which by the way is only one-fifth of the 3,000 rolls that Japan brought over but had not room to display. The educational display also of Japan, though not by any means so large as that of Germany, is equally illustrative of the very up-to-date methods of the Japanese educational system. Here one may see the work turned out by the Imperial School of Art at Tokyo, or he may study samples wrought by tiny fingers in the Japanese kindergarten schools; while near by are some delicate instruments for measuring seismic disturbances, that are reminiscent of that great scourge of Japan—the earthquake.

Great Britain.

If much of the success of the German exhibition is due to Emperor William it must also be admitted that the very fine effort made by Great Britain at the fair is largely indebted for its success to King Edward, who devoted much personal attention to the subject and secured the appointment of the Prince of Wales as Chief of the British Commission. Great Britain is one of the foreign nations that have expended much of their appropriation upon the pavilion which forms the headquarters of the commission. It was determined in making choice of the type of architecture to be followed that the Royal Palace of Kensington would be very representative of English domestic building at one of its happiest periods, and that the structure would serve as a tribute to the memory of that great architect, Sir Christopher Wren, to whom Great Britain is indebted for her great national cathedral in London. The Orangery, which is 170 feet long, has a long line of roof broken only by three brick parapets or pediments. Built of red brick with white stone relief, with its surrounding gardens illustrating the Dutch gardening which was brought in by William, Prince of Orange, the building admirably portrays one of the best schools of architecture of a people who have ever been famous for the comfort and quiet dignity of their domestic homes.

The interior of the building is in part a reproduction of the furnishings and fittings of that day, and it contains several rooms that are illustrative of the best interior art with some of the leading firms in Great Britain. The British exhibit, although by no means so large as the two already mentioned, is nevertheless very extensive, and is indeed the finest ever made by that country at an international fair. The portion of it that perhaps is attracting most popular attention is the superb exhibition of the Queen's Jubilee presents, shown in one of the stone buildings of Washington University, which latter forms the home of the exposition administration. As befits the greatest maritime nation in the world, a large section of the Transportation Building is devoted to a display made by many of the leading British steamship and railway companies. The models of steamships are particularly fine, notably the historical group shown by the Cunard Steamship Company, in which is to be found a superb model of the 800-foot, 25-knot turbine steamers that are now under construction for that company. In the southwest corner of the Varied Industries is to be found a collection of British exhibits, every one of them of a very high order, showing the best work of Great Britain in various arts and crafts, and notably in that of interior decoration, in which she has won for herself such a well-earned repute. Large space has been taken up in both the Agricultural Building and the Liberal Arts with characteristic display; but it is in the Fine Arts Building that she has made her supreme effort; and here we find a rich collection of the very best work of the modern English school. In closing our notice mention should be made of a small building in the southeast corner of the grounds devoted to the exhibition of low-temperature experiments; in connection with which lectures are given bi-weekly and practical demonstrations made of the remarkable results that have been obtained in this field by the physicist during the past few years.

France.

France easily holds her place in all those lines of competition with the other nations of the earth at the World's Fair in which she has made exhibits, and in cases where special effort has been made the nation is rightly entitled to hold first place. Although her display is not comparable in size and variety with that of some of the nations, it is, as far as it goes, exceedingly fine and is surely entitled to take rank with that of Great Britain. Her greatest effort, however, has been expended upon the handsome pavilions and extensive and beautiful gardens which surround it. Copied after the Grand Trianon at Versailles the structure embodies all the beauty of French architecture in the Renaissance.

The pavilion is a reproduction of a chateau which was built by Louis XIV. for Madame Maintenon. All the government factories aided in furnishing and decorating the building, which, both within and without, is in itself an extensive exhibit of the best in French art and architecture. France is represented more or less in every section of the grounds, but her finest exhibits are the automobiles of which she shows some 40 or 50 of her very latest types in the Transportation Building; her superb line of costumes, high-priced gowns, furs, toilet articles of dainty design and exquisite finish; and last and perhaps finest of all, her rich and varied display in the Fine Arts Building. In the heavy engineering trades France has not done as much as in former national expositions; but what she has shown bears the characteristic excellence of material and beauty of finish to which we have become accustomed. A large vertical triple-expansion high-speed engine of 1,500 horse-power in the Machinery Building, and a handsome De Glehn express compound locomotive in the Transportation Building bear testimony to the skill of the mechanical engineer; but one could wish that France had done more in these lines where she has won such world-wide reputation.

THE PENETRATING POWER OF "N_1-RAYS."

Prof. Blondlot recently drew attention to a novel kind of N-rays, diminishing, instead of augmenting, the phosphorescence of calcium sulphide. These rays, called by him "N_1-rays," are given off from a Nernst lamp simultaneously with the N-rays, and are also produced by stretching out a copper, silver, or platinum wire.

In a memoir recently presented to the French Academy of Sciences, Mr. Julien Meyer describes some experiments with these N_1-rays, produced by an extended glass or copper wire or else by a closed glass tube in the interior of which the pressure is diminished. The glass of the tube, on account of the strain resulting from the difference in pressure, was in fact found to be a powerful source of N_1-rays. The brilliancy of a screen covered with sulphide spots and introduced into a glass bulb resting on the plate of an air pump would diminish when the machine was

started, but would recover its initial value as the air was allowed to re-enter. If the sulphide screen be placed outside of the bulb, the phosphorescence would likewise diminish from the very first stroke of the piston. An incandescent lamp bulb, not traversed by any current, a hydrogen Geissler tube, a Crookes' tube, were all found to be sources of N_1-rays without being actuated by a Ruhmkorff coil.

While the N_1-rays from a Nernst lamp are arrested by an oxidized lead plate or by a sheet of moistened paper, those issuing from the sources named are gifted with a high penetrating power; in fact, the action of incandescent lamp bulbs on the screen is not appreciably diminished if between the bulb and the screen there be inserted a board 10 centimeters in thickness or a sheet of oxidized lead one millimeter in thickness and folded round itself so as to be traversed eight times, or else a glass vessel filled with pure water. Pasteboard, paraffin, aluminium, zinc, iron, copper, silver, gold, mercury, and the hand are also transparent to these radiations. The only opaque bodies found were platinum of a thickness of 1 millimeter and opalescent glass 3 millimeters in thickness.

While examining the refraction of the rays by means of an aluminium lens, the author stated that this metal would store the rays in great amounts, giving them off again for more than twenty-four hours after it had been withdrawn from the source. A similar power, though of smaller intensity, was found in the case of ordinary glass; while lead, copper, and pure water did not show it.

Salt water and a solution of sodium hyposulphite in water, on being submitted to the action of a source of N_1-rays, would become active themselves, acting as sources for a very long time.

When the hand is held for some time at a small distance from a source of N_1-rays or touching the latter, the hand would diminish itself the phosphorescence of the screen, this property being kept for some minutes.

N_1-rays as given off from the above sources are refracted by glass, copper, and aluminium prisms and diffracted by a grating.

THE POSITION OF THE RANGE FINDER ON A WARSHIP.

The British Admiralty has suspended the practice of fitting the position of the range finder on an electric-light platform placed on the foremast of a warship. It is imperative, to facilitate the firing of the guns, that the means of ascertaining and transmitting the range from the vessel to the antagonist be communicated to the gun crew with complete security, from a perfectly reliable observing position. The decision of the Naval Department is due to the result of the engagement between the Russian warship "Variag" and the Japanese fleet. In this conflict the men operating this vital department were rendered *hors de combat* early in the engagement, with the result that the gun crews on the "Variag" labored under great disadvantages. From this it is conclusively demonstrated that any observation post placed in the fighting tops is impracticable. The Japanese themselves have also recognized this crucial point, and in their new vessels that are in course of construction in England, special armored observation towers are to be erected at various advantageous positions on the ships for the installation of the range-finding apparatus. In the case of the British Naval Department no decision has been arrived at, though the matter is under discussion and investigation.

RENARD'S NEW BOILER FOR AIRSHIPS.

It is reported that Col. Renard, the well-known director of the government aerostatic park near Paris, has succeeded in constructing a new type of extra light boiler. He expects that it will go far toward solving many important problems, both in aerial navigation and the marine. In 1894 he commenced to study a light form of boiler which could be applied to aerial navigation, and built a first specimen of 80 horse-power which weighed no more than 1.50 kilogrammes (3.36 pounds) per horse-power. Encouraged by this success, he commenced to design a high-power boiler of the same type which should give 1,000 or 1,200 horse-power, in view of using it for the marine. The problem was not an easy one, as it was required to obtain a rapid vaporization and high production while keeping down the weight or the space occupied, and remaining within the limits of 2 kilogrammes per horse-power, or one-fourth of the weight of the lightest boilers known. Some time ago Col. Renard brought out the first boiler of 300 horse-power in which he claims to have realized all the above conditions. It consumes but 0.434 kilos per horse-power-hour, while the best European boilers take 0.700. It heats very rapidly, and at the end of 7 minutes the pressure is sufficient for working; in 15 minutes it is brought up to the normal rate. He uses liquid fuel, heavy oil, which is inexplosible. The apparatus is also completely smoke-consuming. Such a smokeless boiler, rendering a warship invisible at a distance, will be greatly appreciated in the marine. The steam which is produced is absolutely dry. Another remarkable quality of the new boiler is the absence of external radiation. It does not give off any perceptible heat in the boiler room. It is extinguished in half a minute, cooling down at once. According to the latest reports, the French government is convinced of the advantages which can be obtained from such a boiler in the marine, and is about to test it upon two vessels of the fleet. In the case of torpedo boats, allowing the same speed as before, the radius of action would be increased from 175 to 683 miles. Or with the same radius the speed increases from 31 to 35 knots. For a warship of modern type (keeping a speed of 10 knots) the radius of action would be increased from 9,000 to 24,300 miles, nearly tripling the distance and allowing the vessel to make a complete passage around the globe without taking on combustible. The details of the system are of course kept secret for the present.

A NEW CUNARDER.

The new twin-screw liner for the Cunard transatlantic intermediate service has been launched on the Clyde, from the shipyard of Messrs. John Brown & Co., Ltd. Mrs. Choate, the wife of the United States ambassador to Great Britain, performed the launching ceremony. This vessel, which is named the "Caronia," is the largest which has been built in a Clyde yard. It is 678 feet in length, beam 72 feet, depth to shelter deck 52 feet, and displacement 21,000 tons. It is fitted with ordinary reciprocating engines developing 21,000 horse-power and capable of attaining a speed of 18 knots. The vessel will have accommodation for 300 first-class, 350 second-class, 1,000 third-class, and 1,000 steerage passengers, while the crew complement will number 450. This vessel is a remarkable example of rapid construction. The keel was only laid in September last, and the steelwork is now practically completed, while the woodwork is far advanced. The sister ship "Carmania," is also in course of erection at the same shipyard. This vessel is to be fitted with the Parsons turbines and it is with these two vessels that the Cunard company intend to obtain comparative data concerning the advantages and merits of the two systems of propulsion for Atlantic liners.

THE NATIONAL GEOGRAPHIC CONGRESS.

The National Geographic Congress which will be held in this country in September promises to bring together an unusually large assembly of an international character, for the committee of arrangements have received information that many of the most noted savants of Europe will be present and take part in the various sessions. The congress will be the seventh which has thus far been held, the last meeting at Berlin in 1899. While it will be convoked in Washington, meetings will be held not only in that city, but in Philadelphia, New York, Chicago, and St. Louis, in connection with field sessions on the Hudson River and at Niagara Falls. From the present indications nearly, if not actually a thousand scientists will attend, and the committee in charge has the promise of a wide variety of papers on various subjects by authorities whose reputation is international.

Under the subject of physiography will be discussed meteorology by such authorities as Prof. R. DeC. Ward, Cambridge, Mass.; Prof. R. F. Stupart, Ottawa; Dr. W. Meinardus, Berlin; Dr. K. Kassner, Prussian Meteorological Institute; Henryk Arctowski, Brussels, Belgium. Oceanography will be treated by Prof. R. A. Harris, Washington; Prof. Knipowitsch, St. Petersburg; Sir John Murray, Edinburgh; Prof. J. J. Rein, Bonn; Prof. E. Witte, Brieg, Germany; Prof. J. Thoulet, Nancy, France. Among those who will discuss volcanoes are Dr. Hovey and Prof. Heilprin, of this country, and Paul de la Blache, of Paris. The writers on earthquakes will include Count de Montessus de Ballore, Abbeville, France; Prof. E. Rudolph, Strassburg, Germany; Prof. A. Schmidt, Stuttgart, Germany; Prof. de Kovesligethy, Budapest, Hungary. Those on glaciers will include G. Vaux, Jr., Philadelphia, Pa.; Dr. Axel Hamburg, Stockholm, Sweden; Henry Arctowski, Brussels, Belgium. Other divisions will include mathematical geography and the economic features of geography, while it will be treated also from the historical and educational point of view.

In addition to the authorities referred to, others who will participate are as follows: Dr. Oskar Drude, Dresden; G. Grandidier, Paris; Prof. F. Starr, Chicago; Prof. W. J. McGee, Washington; A. Chevalier, Paris; C. Rabot, Paris; Mrs. Fanny Bullock Workman, Worcester; Robert T. Hill, Washington; D. C. Gilman, Washington; Henry Gannett, Washington; A. de Claparede, Geneva, Switzerland; Dr. A. Funke, Berlin; C. Gauthiot, Paris; Sir H. H. Johnston, London; Prof. E. T. Gautier, Algiers; Georges Blondel, Paris; Prof. Guido Cora, Rome; Gilbert H. Grosvenor, Washington; Dr. Eugen Oberhummer, Vienna.

The congress will convene formally in Washington on September 8, in Philadelphia on September 12, and in New York the following day. From New York the party will go to Niagara Falls, where a general field meeting will be held in charge of geographers familiar with the region. The members will assemble in Chicago on September 17 and in St. Louis on September 19, the congress formally closing on September 22. The programme, however, includes a southwestern tour from St. Louis, which will include the Grand Canyon of the Colorado and a portion of Mexico.

The hosts of the congress will be the various societies interested in geography in the United States. These include the National Geographic Society, American Geographical Society, Geographical Society of Philadelphia, Geographic Society of Chicago, Geographical Society of Baltimore, Geographical Society of the Pacific, Geographical Society of California, Peary Arctic Club, Appalachian Mountain Club, American Alpine Club, Mazamas, Sierra Club, and Harvard Travelers' Club.

THE AUTOMOBILE TOUR TO THE WORLD'S FAIR.

The St. Louis tour has progressed finely during the past two weeks, and the participants make up in enthusiasm what they lack in numbers. Sixteen machines started from New York on Monday, July 25. One of these—a Yale touring car equipped with solid tires—broke its transmission gear and dropped out during the second day's run, the accident being caused by the carelessness of a repair man who left a small tool in the transmission gear case when overhauling the car before its start. This car was repaired and rejoined the others at Toledo. Its performance will be watched with interest, as it is the only car equipped with solid tires. The place of the Yale car was filled the third day by J. H. Waters' 24-horse-power Panhard, which made the entire 150-mile run from New York to Albany on July 26 in 12 hours, 35 minutes. This and the two 40-horse-power Mercedes cars of Harlan W. Whipple and James L. Breese, which joined the tour at Albany and Buffalo respectively, were the only foreign cars entered. Their performance over American roads has been very creditable, although Mr. Whipple's Mercedes seems to have had a considerable number of breakdowns to its mechanism. Eleven cars reached Albany from Boston and other eastern points, and, in all, twenty-four started for and reached Utica the third day. There had been considerable rain and the roads were execrable. There were several skidding accidents, but Harold Pope's Pope-Hartford car was the only one to be damaged. This machine bent its front axle by skidding into a gutter. A 3,600-pound Peerless machine skidded off the road, but, with the aid of horses and tackle, it was finally got on again. A protest was made to the county authorities about the condition of the road, to the effect that "throughout the civilized world there does not exist a road in such wretched condition that connects so many important cities and towns." From Utica on, the roads were fair, although heavy in many places on account of rain. Buffalo was reached Saturday, July 30, and was left Monday. The second week the tourists finished at Chicago. The principal events of this week were a night run from Erie to Cleveland, participated in by five White steam touring cars and one Royal; a 121-mile run over bad clay roads from Cleveland to Toledo in one day; and the entrance into Chicago under escort of numerous automobilists of that city, on Saturday. Ten machines joined the tour at Cleveland, making thirty-four in all. The only accidents recorded were the overturning of a runabout by slewing in deep sand and the running into of an express train by the huge 70-horse-power Peerless car at a dangerous grade crossing. Although both car and train were damaged, no one was seriously hurt. The puncturing and giving out of tires, especially on the heavy cars, has been one of the most troublesome features of the tour. One touring car had four inner tubes burst in a single day. The almost universal use of double-tube tires renders repairs on the road a comparatively easy matter, however. The combination runabout and light touring car has shown itself just as reliable and as capable as has the powerful touring car, with the additional advantage of less tire trouble.

The two-cycle Elmore tonneau in the present tour had just finished a trip to St. Louis before starting out this time, while F. A. La Roche, in a Darracq touring car, succeeded in beating the world's record non-stop run, by traveling to St. Louis and back as far as Columbus without once stopping his engine. He hopes to create a record of 3,000 miles, the old one being 2,017.

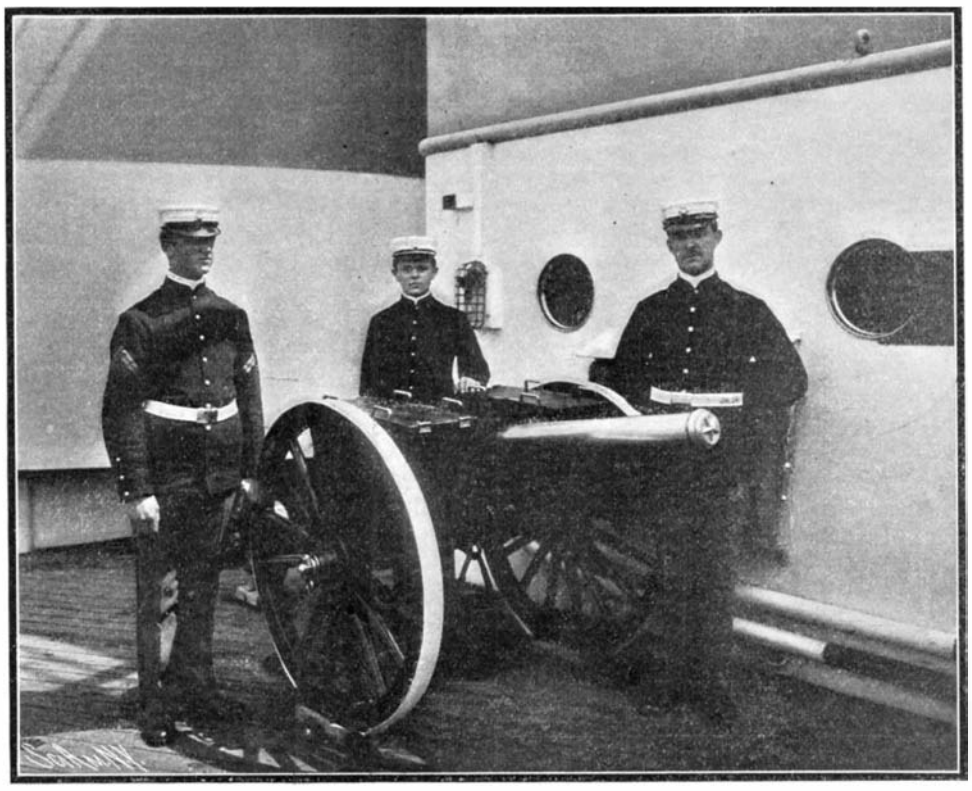
It is not yet half a century since Col. Drake discovered petroleum on the waters of Oil Creek, near Titusville, Pa. The total production of crude petroleum from 1859 to 1902—forty-three years—has been no less than 1,165,280,727 barrels. Of this output, Pennsylvania and New York contributed 53.9 per cent; Ohio, 24.3 per cent; West Virginia, 11.3 per cent; Indiana, 3.9 per cent; California, 3.6 per cent; Texas, 2.1 per cent, leaving 9 per cent to be supplied by Kansas, Colorado, Louisiana, Illinois, Missouri, Indian Territory, Wyoming, Michigan, and Oklahoma.

THE UNITED STATES MARINE CORPS.

BY WALDON FAWCETT.

The United States Marine Corps is an organization which antedates the Constitution of the nation, but it is only during the past few years, or, to be exact, since the Spanish-American war, that it has gained general recognition as one of the most valuable and important branches of our fighting service. There has been a disposition on the part of some persons to confuse the marines with the seamen or "blue jackets" of the navy, from whom they are in reality entirely separate and distinct. Indeed, the marines more closely resemble soldiers than sailors although their duties partake of some of the characteristics of each service.

On shore duty the marines conform to army regulations and are expected to combine to a considerable extent the functions of the infantryman, engineer, signalman and light artilleryman. In order to permit this versatility of operations the working equipment of a detachment of marines detailed for shore service embraces Krag rifles, Colt automatic, Gatling, or some other type of rapid-fire guns, picks and shovels for throwing up entrenchments, and apparatus for signaling by night or day. On shipboard the marines have nothing to do with navigating the vessel, but man the secondary batteries, act as sharp-shooters in the military masts, and in the event of a conflict at close quarters are depended upon to repel the attacks of boarders. The United States marines range from eighteen to thirty-five years of age and have an average height of five feet six inches. The men enlist for a period of five years and receive from $13 to $22 per month, in addition, of course, to food, clothing, medicines and, in short, every necessity. The privates of the Marine Corps are not sent to sea until after they have been thoroughly drilled in their various duties at one or another of the training schools maintained at Washington, Annapolis, Brooklyn, Norfolk, Boston, Portsmouth, and League Island. The work of these institutions includes the drills of the soldier, company and battalion, skirmishing, target practice, and bayonet exercise as well as all military duties and ceremonies. The marines wear khaki when occasion warrants, but are possessed of a full-dress uniform, which is possibly the most conspicuous worn in any branch of the United States military service. The caps and coats are of dark blue; the trousers and overcoats of light blue, trimmings being of scarlet. The marine, when on board ship, is assigned the regular blue-jacket ration, which is accounted as equivalent to thirty cents, but, when on shore, receives the army ration, which is rated at seventeen cents per man per day. When landed from war vessels it is, of course, essential that the marines travel in light marching order and accordingly they do not make use of the regulation army tents but use instead the Sibley tents. One of these tepee-like shelters will accommodate sixteen men, sleeping with their heads together at the center pole and their bodies reaching out in all directions like the spokes of a wheel.



UNITED STATES MARINES WITH FIELD PIECE.

While the marine is supposed to know something of the sea he is not presumed to be a good seaman, and is never called upon to help coal the ship or perform other tasks which rank as the especial duties of the enlisted men of the navy. For the most part the work of marines afloat is made up of such light tasks as guard or sentry duty and service as "mail orderlies" or official messengers between ship and shore. The marines are entitled to much of the credit for the superior marksmanship which has been the most striking feature of this country's naval progress since the Spanish war. Formerly the responsible position of gun-pointer was open only to seamen, but now there is an opportunity for any enlisted man on a warship to win the extra pay and prizes which attach to this coveted post, a gun-pointership being a rating rather than a position. Not only are numerous marines serving as gun-pointers, but there are on the prominent American naval vessels not a few guns which are manned entirely by these "soldiers of the sea."

One of the most important but little emphasized functions of the United States Marine Corps is found in its influence against mutiny on the vessels of the American navy. The necessity for such a safeguard will be better appreciated when it is taken into consideration that in seeking men for the rapidly-growing navy the enlistments sometimes show twenty foreigners to one American, and it is hoping for too much to expect a set of foreign sailors to be true to the flag under all circumstances. The marines, on the other hand, are almost without exception American born and the detachment on a ship constitutes a body separate and distinct in interests and sympathies from the crew proper.

Officers of the Marine Corps are on the same footing as to rank and privileges as similar grades in the army. Of late a movement has been inaugurated to give them a higher degree of technical knowledge, and applicants for an officer's position in the corps must spend a year or more in the Annapolis school for the instruction of commissioned officers of marines. The increasing governmental appreciation of the value of the Marine Corps as a branch of the military establishment is found in the fact that whereas, a few years ago, the ranking officer of marine could have no higher rank than colonel, Gen. Elliott, the new commandant, has the rank of brigadier-general and has fully 8,000 men under his direction. Of this full strength several hundred are boys, ranging from fourteen to twenty-one years of age, who have been enrolled as buglers and drummers, and two of whom are attached to every United States war vessel carrying marines.

THE MERCURY VAPOR LAMP FOR PHOTOGRAPHIC WORK.

BY FRANK C. PERKINS.

The mercury vapor lamp, unlike its rivals in artificial illumination, derives its light from the vapor of mercury, which is raised to a high state of incandescence by the electric current passing through it. The light produced by all of the other forms of electric lamps depends on the incandescence of a solid, which is sometimes carbon and at other times other material in the form of rods or filaments, as in the arc lamp, the incandescent lamp, and the Nernst lamp.

The accompanying illustrations (Figs. 1 and 2) show the mercury vapor lamps as employed in the photographic studio of Mr. E. C. Pratt, at Aurora, Ill. The illustration, Fig. 1, shows the Cooper Hewitt lamps in position for making negatives, the mercury light being used as a perfect substitute for daylight, while

(*Continued on page 111.*)

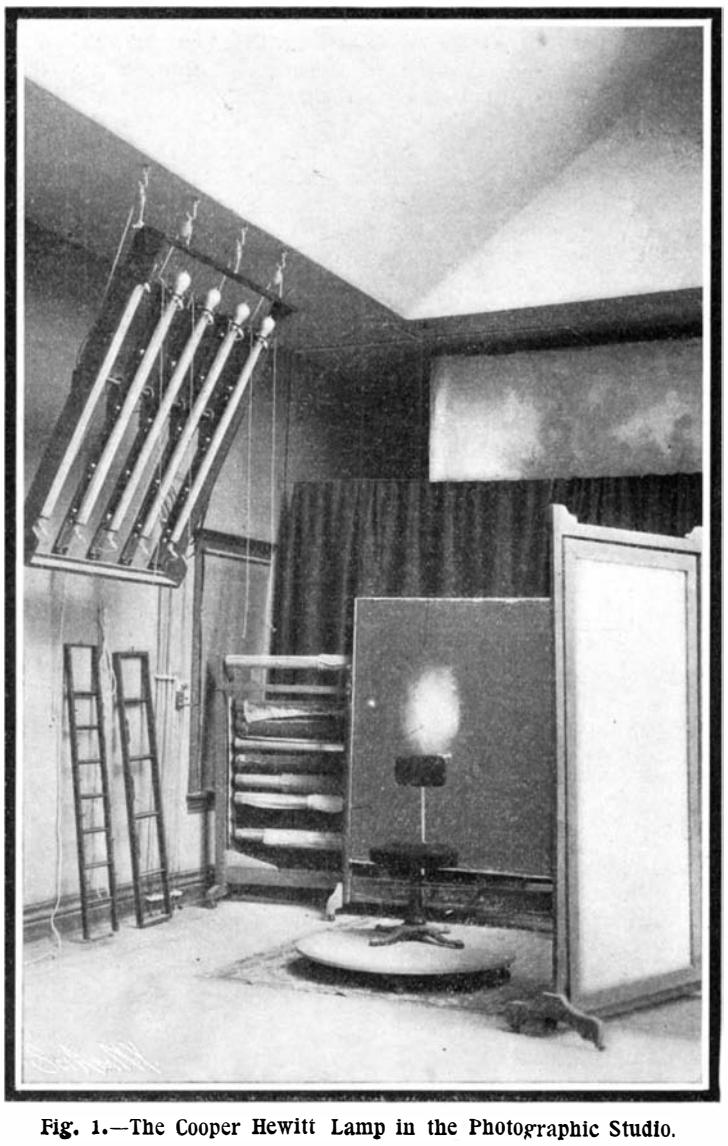


Fig. 1.—The Cooper Hewitt Lamp in the Photographic Studio.

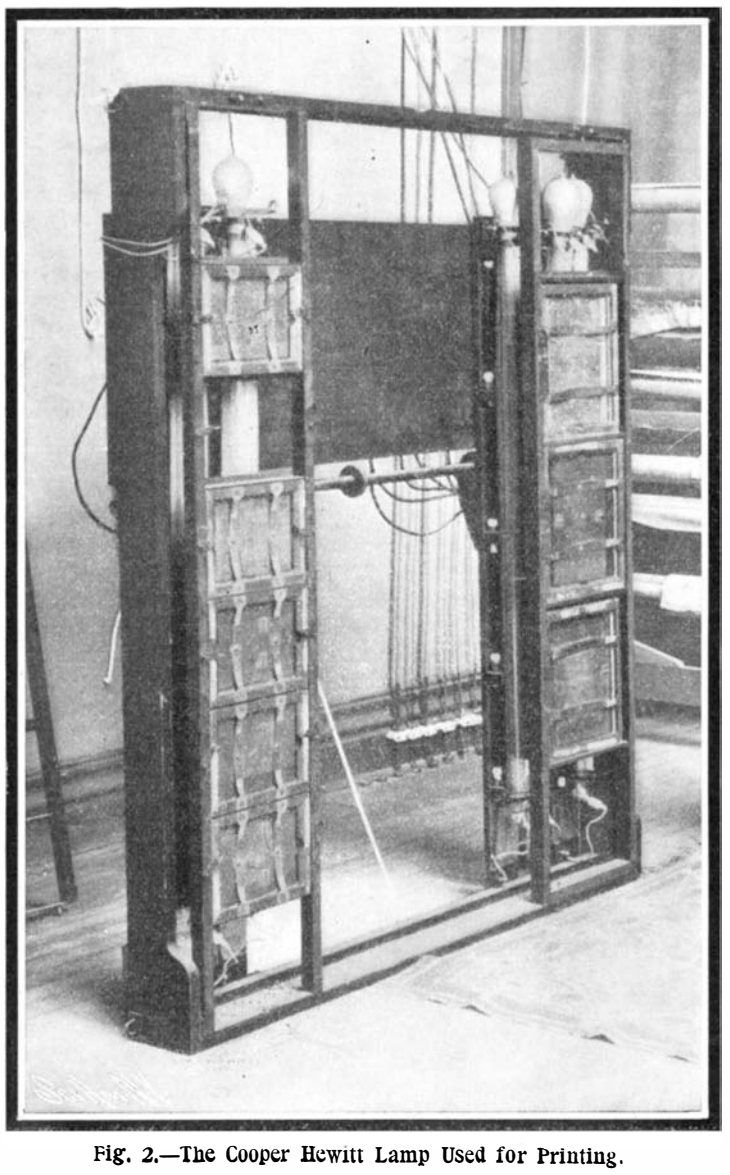


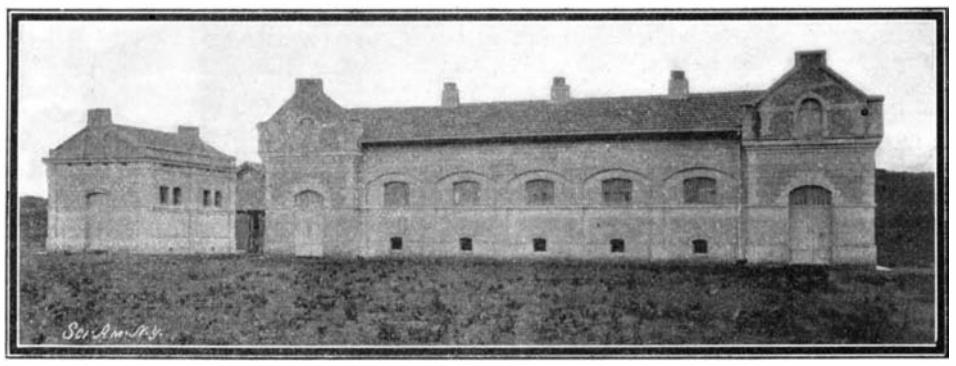
Fig. 2.—The Cooper Hewitt Lamp Used for Printing.

THE MERCURY VAPOR LAMP FOR PHOTOGRAPHIC WORK.

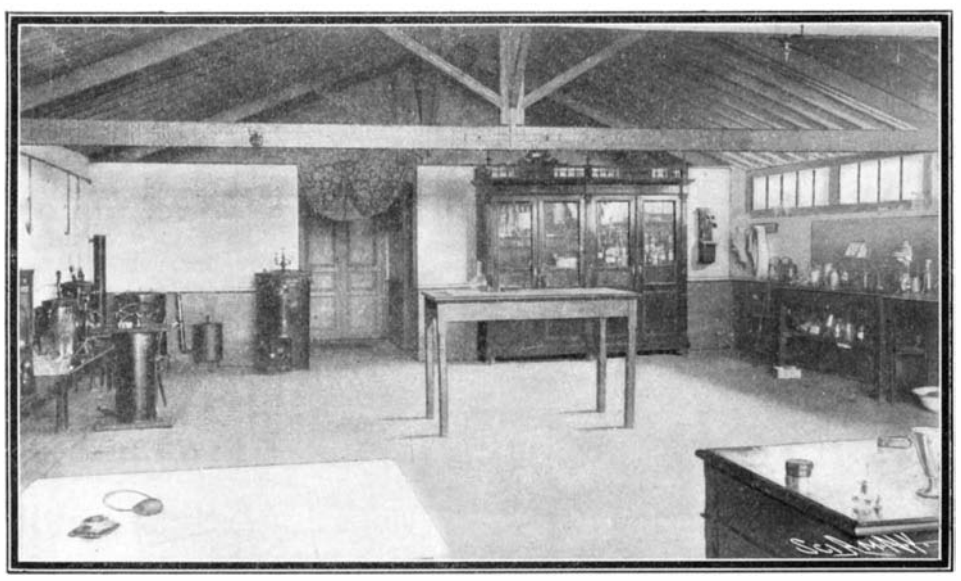
THE UTILIZATION OF SNAKE VENOM IN PREPARING ANTI-BUBONIC SERUM.

BY A. F. SHAW.

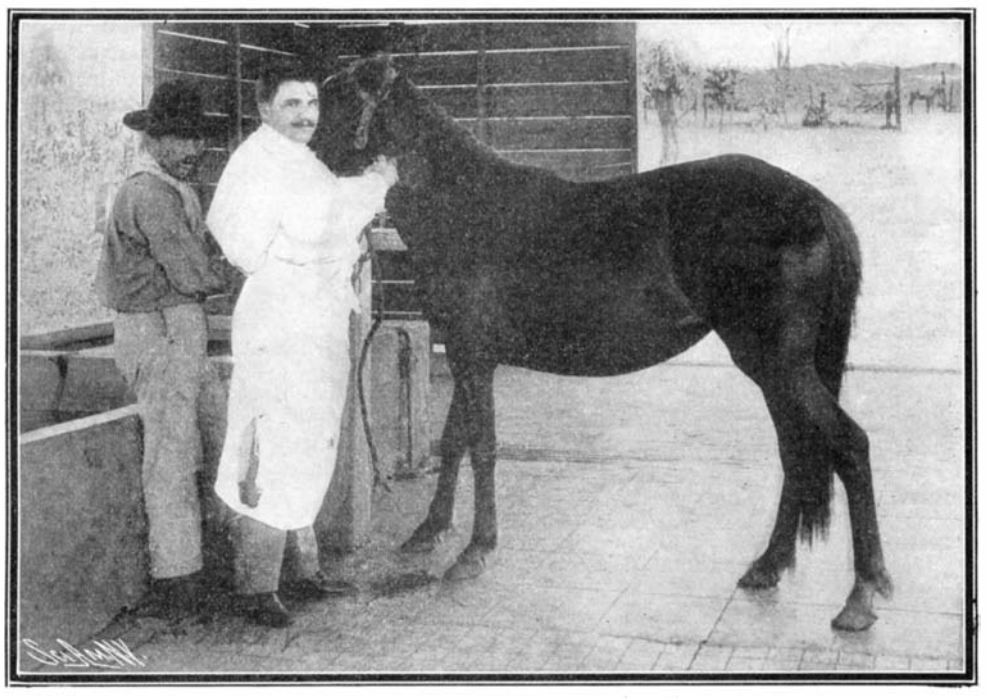
Two years ago, when the bubonic plague was making many victims here in the city, the supply of anti-bubonic serum in Rio de Janeiro being insufficient to meet the needs of both cities, the "Instituto Serumtherapico" was opened for its manufacture. Dr. Vital Brazil, educated in the American school of this city and the medical school of Rio, a man who had shown his fearlessness of the disease by fighting it at Santos when it was at its worst, was put in charge. The wisdom of the choice is clearly manifest now, not only because of the results obtained along the lines laid down at the beginning, but along others which will soon be mentioned.



EXTERIOR OF MOSQUITO-PROOF BARN.



TEMPORARY HOSPITAL WHERE SERUM IS PREPARED.



INJECTING THE POISON INTO THE VEINS OF A HORSE.

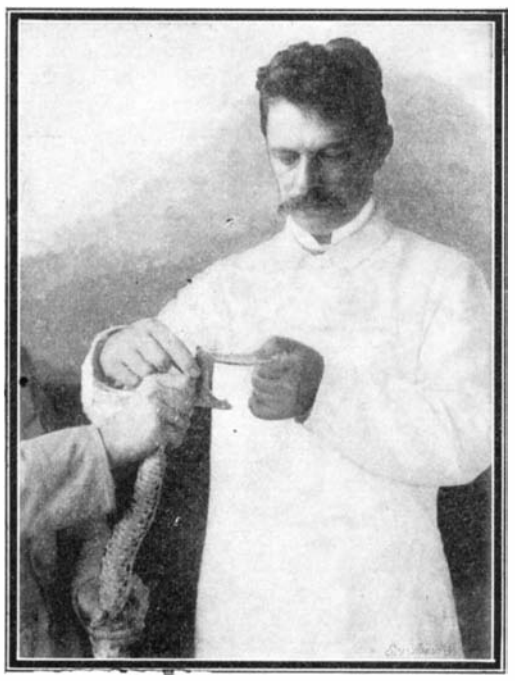
The Institute is about four miles away from the city, on a hill, with commanding view and plenty of pure air. The residence of Dr. Vital, the laboratory, the barns where the horses and mules are kept which furnish the serum, and numerous cages for rabbits and snakes, form the plant. The laboratory is as yet temporary. One of the barns is completely mosquito-proof and here are kept the animals which furnish the antibubonic serum. The second barn is for animals immune against snake bites.

This brings us to the second class of results obtained. Dr. Vital has been studying for years the snakes of Brazil, and influenced not only by scientific reasons but by humanitarian motives, has made a special study of snake bites and their antidotes. From two to three thousand people, it is estimated, die annually in Brazil from snake bites. This enormous mortality is due to the fact that, in the interior, the laborers work without shoes or stockings. Dr. Vital has proved conclusively by a long series of experiments that the ordinary antidotes used in the case of snake bites are not always sure nor safe. Permanganate of potassium is effective if injected in the exact place of the bite and immediately; cauterization destroys the tissues and with them the poison, but if not done immediately is useless. He has also experimented with the numerous herbs, concoctions of which are used, but the results have been negative in every case. Many of these remedies have been used with apparent success simply because only 25 per cent of snake bites are fatal.

In order to carry on these experiments a number of snakes were necessary. To catch them Dr. Vital chose a lasso invented by Dr. Lutz, of this city, which consists in a strap which passes around the end of a stick and under a metal bridge to which a cord, a little longer than the stick, is attached. The strap when loose furnishes a noose which can be slipped over the head of the snake, and on being tightened, secures the head of the snake against the stick. This is the method used both to catch wild snakes and those in captivity when their poison is to be extracted. Having caught the snake the assistant grasps it behind the head, and the doctor, with small pincers, pries open its mouth, pushes the membrane from the fang, and seizing its head, with thumb and forefinger on the poison-producing glands, presses out the clear liquid in drops. This liquid is then evaporated at 38 deg. C. or in the sun and is ready for solution when necessary.

"The poisonous snakes of Brazil," says Dr. Vital, "belong to about twenty species and these to two families, Crotalidæ and Elapidæ. The family of the Crotalidæ is without doubt the more important, because it includes almost all the species the bites of which are either serious or fatal. The Crotalidæ belong to the sub-order of Solenoglyphs. In the anterior part of the upper maxillary there is, on each side, a tooth much larger than the others, curved and capable of movement, which is the poison fang. It is jointed to the upper maxillary in such a way that it lies against the roof of the mouth when the snake is in repose, but when in the act of biting it assumes a vertical position. The tooth has a canal which leads from the poison gland to an oval opening near the end of the tooth.

The learned naturalist George Albert Boulencer, of the British Museum, classifies the Brazilian Crotalidæ in two genera, the genus *lachesis* and the genus *crotalus*, and the only species of *crotalus* is the *Crotalus horridus* or rattlesnake. This is abundant both in the northern and southern parts of Brazil." The poison extracted from rattlesnakes is a dense and milky liquid, slightly acid and white when dry, while the poison from lachesis is yellow. "The quantity furnished (to make a somewhat free translation from articles published by Dr. Vital in the Revista Medica de Sao Paulo) depends, among other circumstances, on these three principally—the size of the snake, its physiological condition, and the period of inertia or the time elapsed since it last bit. As to the first, we find what we would expect, that the larger the snake the better developed are its poison glands; as to the second, when the serpent is sick, the quantity of poison diminishes or disappears entirely, and as to the third point, experience has shown that at least ten or fifteen days are necessary for the production of a normal quantity of poison. The amount of poison varies, moreover, from time to time, but the average has been found to be about 0.04 grammes of dry poison or nearly four times that weight of liquid.



FORCING OUT THE SNAKE POISON ON A WATCH CRYSTAL BY PRESSING ON THE POISON-SECRETING GLANDS.

GRIPPING THE SNAKE.

Dr. Vital says that the poison from rattlesnakes is much more virulent than that of other species that he studied, but that the manner of introducing the poison has great influence on the rapidity with which it takes effect. Introduced in the veins, all poisons take effect much more quickly than when injected hypodermically.

Various other scientists have studied not only means of cure, but means of rendering animals and persons immune. Sewall in 1887, Kaufman in 1889, Calmette, Physalix and Bertrand in 1894 succeeded in making small animals immune by repeated injections of very small doses of poison. The brilliant study of Behring, Kitasato, and Roux of the preventive and curative properties of the serum from animals immune to diphtheretic toxine opened new horizons to experiment.

As a matter of fact, the verification of identical properties in the serum of animals immune against snake poison was made almost at the same time by Calmette, Physalix, and Berthand, these experimenters arriving at the conclusion that it was possible to obtain a serum sufficiently active against snake poisoning by following a process analogous in the preparation of the animals which furnished the serum. Calmette makes the animals immune by injecting continually increasing doses of poison with continually decreasing doses of hypochlorite of calcium. Dr. Vital does not use hypochlorite nor any substance which neutralizes the effect of the poison, but commencing with infinitely small doses of the poison in a salt solution of 7 to 1,000 succeeds, in the course of a year, in rendering animals not only immune, but capable of receiving, at one time, doses of poison that would kill one hundred animals of equal weight. One of the illustrations shows a horse that has been made immune in this way and is now receiving 100 milligrammes a day.

While repeating the experiments of Calmette and while using his serum, Dr. Vital found it to be ineffective, much to his surprise, and on further experiment, made the important discovery that there are two classes of snake poison, the bothropic and the crotalic, the first belonging to the genus *lachesis* and the second to the genus *crotalus*. With these he made two types of serum, the antibothropic and the anticrotalic, each of which is effective only in bites of snakes of the same class as that which produced the serum. This important discovery explained, therefore, the ineffectiveness of the serum of Calmette which is taken from animals made immune by poison from snakes of India. In order to produce a serum of universal efficacy, Dr. Vital mixes equal parts of the other two serums and calls it anti-ophidic. The animals which furnish the serum receive injections of poison every other day in the manner shown by the illustration, and the extraction of the serum is made twice a month, 3,600 grammes of blood being drawn each time. The horses and mules, of which there are eighteen for pest and twelve for snake serum, are kept solely for this purpose and are not used otherwise. The serum is separated from the coagulum by a process invented by Dr. Vital, a process by which the quantity is much larger than in the ordinary processes of separation.

The efficiency of the serum has been proved repeatedly on animals in experiments, some of which the writer has witnessed. Side by side with a rabbit that died in forty-five seconds was another that received a mixture of a quantity of poison equal to that used in the first instance and the proper amount of serum. This rabbit showed no effects. One dove received enough poison to kill it in about an hour and another an equal amount, but soon after the proper amount of serum. The first died and the second lived. An infinite number of similar experiments have been made, always with results almost mathematical in their accuracy. Besides these experiments, Dr. Vital has now a history of persons bitten in which the serum has been successfully applied.

A great figure in the press world of Paris has passed away, according to the Westminster Gazette, in the person of M. Hippolyte Marinoni. He was the inventor of the printing presses which bear his name. As a lad, he was of a mechanical turn. His parents apprenticed him to an engineer in the Rue d'Assas. He brought out the first flat-bed four-cylinder printing machine, and later, in 1872, his celebrated rotary. Meanwhile he had become manager of the Petit Journal, of which the editor at that time was the distinguished publicist Emile de Girardin. The great success of the Petit Journal was due to the "Marinonis," which printed, folded, and cut the papers at the rate of forty thousand an hour. Then a color printing machine was invented by M. Marinoni and thus the well-known illustrated supplement of the Petit Journal became possible. M. Marinoni was of the thorough type of self-made man—a little rough externally, but with a heart of steel.

THE MOUNT PILATUS RAILWAY, SWITZERLAND.

BY EMILE GUARINI.

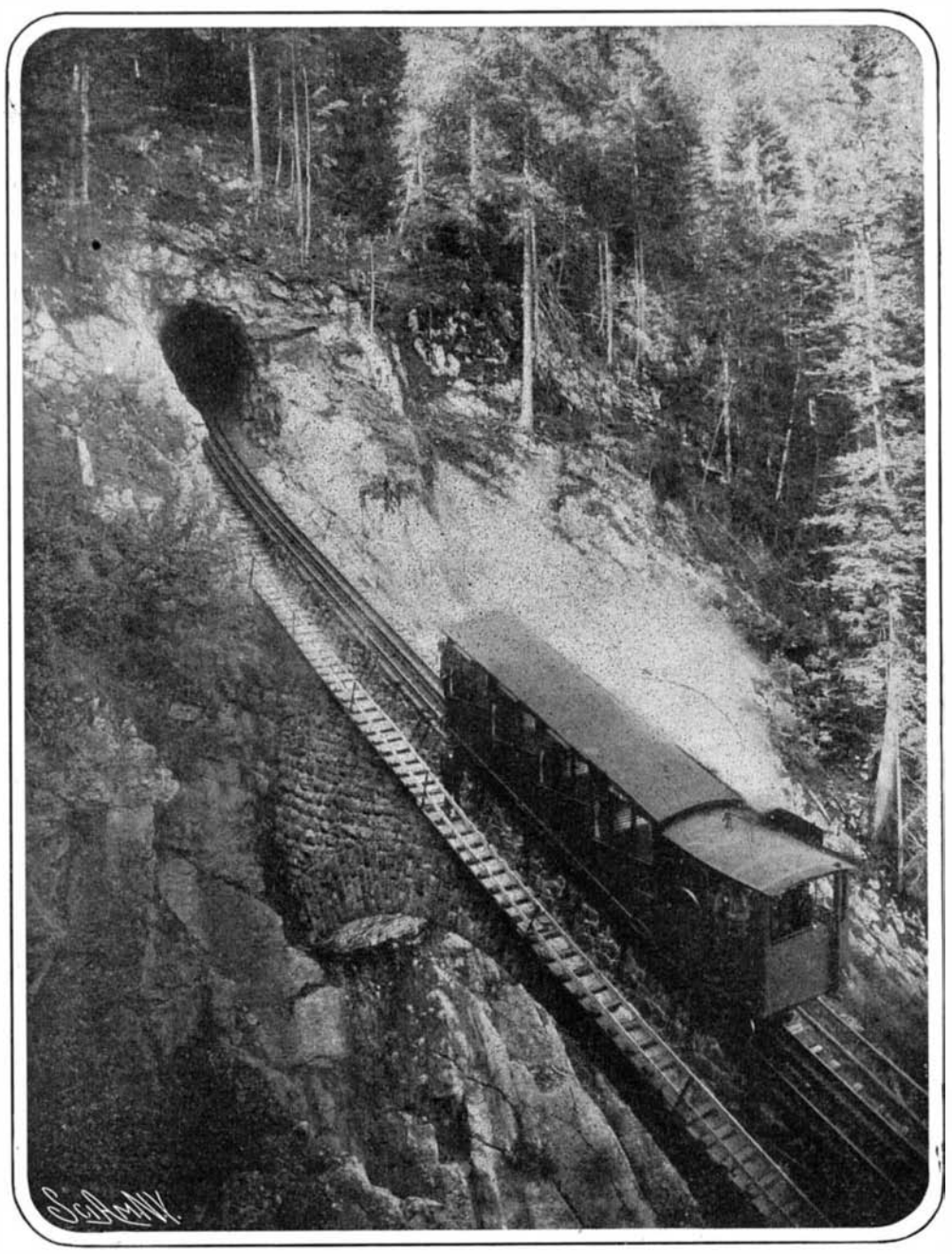
Notwithstanding that there are few assertions that can be made without fear of contradiction, there is one nevertheless that is undeniable and undenied, although the beautiful may be what pleases and its conception may consequently vary with taste, and that is that Switzerland is a beautiful and picturesque country. This is not the opinion of the Swiss alone, who are proud of their lakes and mountains, but of the tourists who come annually from all parts of the world to visit the country. Every one finds it beautiful because every one finds in it what pleases and interests him, and this includes the technical man, as well as the artist, the geologist, the botanist, the man of active life who comes to obtain rest, and the person of leisure who comes because it is the fashion.

Among the innumerable sites that are annually visited by the tourists who travel in Switzerland, Lucerne, that classical resort of foreigners, is, with its lake and remarkable surroundings, assuredly the most picturesque. But, just as one cannot claim to have seen Switzerland without having made the ascent of some one or other of its mountains, just so he cannot say that he has seen Lucerne unless he has ascended Pilatus, which, of all the mountains of Switzerland, is the most celebrated by the writings of which it has been the object, by the splendid panorama there unfolded to view, by the sea of fog that is sometimes seen forming there, by the magnificent spectacle presented to the spectator when he is on the top of the mountain, by the terrible legend of the damnation of Pontius Pilate, and, finally, by its meteorological legend, which has it that when clouds occupy the summit it is a sign of fine weather, and, when they are situated half way up, it is a sign of rain, a fact expressed in the country by the following archaic stanza:

"Quand Pilate a son chapeau,
Dans le pays il fait beau;
Mais quand il ceint son epé,
Gare l'ondée."

Formerly, when the ascent of Pilatus was made (an event that for centuries could not take place without a special permit for fear that the visitor might disturb the soul of Pilate and let loose a scourge upon the country, but in reality because certain lakes had for a long time been the refuge of a pagan cult), it was made by following a steep footpath that started from Alpnach-Staad and ended at the summit. It is this footpath that the Mount Pilatus railway follows for quite a long distance. But, while the modest footpath accomodates itself to all the capricious meanderings of the slope, the railway goes straight to the top, boldly crossing narrow passes and ravines, and traversing walls of rock that seem to bar its passage.

When the tourist leaves his conveyance at Alpnach-Staad, he finds himself at the lower station of the rack railway that runs to the summit. He is then at about 1,450 feet above the level of the sea. The car is there, inclined upon the track, the gradient of which is already 36 per cent. The locomotive and the car form a single vehicle. The car is divided into four compartments, placed one above another, and each accommodating 8 passengers. Its lower part is occupied by a water tank having a capacity of 100 gallons. The axles are arranged in such a way that curves of very small radius may be taken despite the distance apart of the axles, viz., 20 feet. Four pairs of cog wheels, two in front and two behind, serve for the propulsion, running, and braking of the vehicle. Rings that embrace the head of the rails prevent the car from being blown from the track in a gale or from running off because of ice or snow that may exist upon the roadbed. The boiler, which is of the tubular type, is 6 feet in length, has a heating surface of 225 square feet, and employs a working pressure of 12 atmospheres. It is placed at right angles with the axis of the track, in order to prevent the various gradients from producing fluctuations in the level of the water. The average gradient is 38.1 per cent; the minimum, 19.2 per cent; and the maximum 48 per cent. The engine cylinders are 8.75 inches in diameter, and the piston stroke is 12 inches. The normal speed of the trip is a little over three feet a second. The dead weight is 9.6 tons, and the load with 32 passengers, 2.4 tons. The locomotive is of about 70 horse-power. The braking arrangement has naturally been very carefully looked after. It consists of a compressed-air brake, an automatic brake, and two friction brakes. The suspension of the vehicle is assured by a system of four pairs of elliptic springs combined with spiral ones. The play of the car is prevented by safety stops, so that the vibrations are no greater than they are in an ordinary well-suspended train.



The Car on its Journey Through Wolfort Gorge.

THE MOUNT PILATUS RAILWAY.

Such, then, is the singular, but powerful engine, constructed by the Winterthour locomotive works of Switzerland, that daily traverses the 5,400 feet which separate the Alpnach-Staad station from that of Pilatus-Kulm, which is at an altitude of 6,800 feet. This altitude is reached by means of a track of 15,150 feet in length, constructed by MM. Lacher and Guyer-Freuber, of Zurich. From the edge of the lake to the top of the mountain, the substructure consists of solid masonry covered with large granite flagstones. The track itself, which is all of iron and steel, is solidly riveted, once in every three feet, to the underlying masonry. The bed for the rack is placed between the two rails, which it slightly exceeds in height. Attached to each side of it is a steel rack with which engage horizontally, on the right and left, the four cog wheels of the vehicle. Numerous bridges had to be constructed under most difficult conditions, and yet, in spite of that, the Pilatus railway, its rolling stock, stations, and shops, cost but $380,000 and took but four hundred days to finish. The track in the first place traverses plains bestrewed with wooden buildings, and then reaches the gorge of Wolfort, at an elevation of 2,950 feet, which it crosses by means of a bridge constructed with surprising boldness. This bridge, which is entirely of dressed stone, is within the radius of 260 feet uniformly adopted for the curves of the track. Its span is 75 feet. The railway afterward enters Wolfort tunnel, 145 feet in length, and then climbs the Risleten, the gradient of which is 48 per cent. In order to cross this critical place, it became necessary to employ a number of hurdles and piles, and to construct subterranean vaults, as well as huge sustaining walls. Continuing the ascent, the tourist reaches a wild region intersected by the two Spycher tunnels, 167 and 318 feet in length. Upon leaving the upper tunnel after a magnificent view of

the lake Quatre Cantons and the Righi, the traveler leaves the forest region and reaches Aemsigenalp at an altitude of 4,590 feet, a charming place provided with an inn and a small wooden structure containing two pumps of small size, but great power, which furnish drinking water to the two hotels situated at about 2,300 feet higher up in a rocky and arid region. The train, after taking a supply of water for the second time, traverses one of the most pleasing regions of Mount Pilatus, and then reaches the huge and fantastic blocks of the Mattalp, whence the view embraces a magnificent panorama of the Matterhorn, the enormous mass of the Esel, and the ridge that connects these summits. The railway then reaches the region of bare rock, describes a curve toward a point of the southeast ridge, and then climbs the wild escarpment of the wall of the Esel. It is difficult to imagine a bolder direction line. At an altitude of about 6,230 feet, four tunnels of 144, 180, 148, and 36 feet here and there pierce the colossal mountain sides. Between the two upper tunnels, there unfolds the panorama of the Bernese Alps. The railway then begins its last climb up a 48 per cent grade, and reaches the Pilatus-Kulm station at about 6,800 feet altitude. The mountain falls perpendicularly upon the charming country of Lucerne, beyond which we discover a vast extent of hills and valleys strewed with blue lakes, cities, and villages, and numerous rivers which, between the low eminences, shine like threads of silver. There are two hotels to receive the tourist, who, from their terraces, obtains a magnificent view over the lake of Quatre Cantons, which appears in such splendor that one does not know what to admire the most, the dark azure of its waters, or the variety of the sinuosities that they form. In order to complete the attraction of Mount Pilatus, the railway company has undertaken the construction of the road which is the most singular in Europe, and that is the Tomlishorn road running from one of the hotels to the peak of the Tomlishorn along the most abrupt of the walls of rock, and ending at a platform whence may be enjoyed a scene such as Switzerland alone is capable of presenting.

But here we are far from the railway, about which we have not much further to say, however, unless it be to speak of the intrepidity of the Italian laborers, who, sometimes suspended by ropes along perpendicular walls of several hundred feet in height, were employed in the construction of the railway, and, finally, to give the number of the travelers furnished by the last annual statistics and which amounted to a total of 44,231, 520 of whom were Americans and 12,011 English. The success of the road is easily explained. The traveler who is not very familiar with mountainous countries and with ascents finds himself here carried gently and without fatigue to the summit of one of the most celebrated mountains of Switzerland, and preserves a deep impression and lasting remembrance of the spectacle that unfolded under his eyes and of the gigantic work that permitted him to see it and that attests both the genius of man and of nature.

THE MERCURY VAPOR LAMP FOR PHOTOGRAPHIC WORK.

(*Continued from page 108.*)

the illustration, Fig. 2, shows the frame lowered to the floor and being used as a printing lamp. Mr. Pratt states that he has made sittings at night with this equipment in the astonishing space of one second. The prints are made with the same light in from 2½ to 10 seconds, according to the density of the negative, and the light only barely heats the negative, but not enough to damage it in the least. These lamps are constructed of glass tubes having metal sealing-in wires at each end. These wires lead the current to the electrodes, one of which is of mercury, and the tubes are exhausted to a high degree by means of a vacuum pump and sealed off, preventing any escape of the vapor which fills the tube.

It is claimed that these mercury vapor lamps produce the most efficient electric light known, the current consumption being about 0.4 watts per spherical candle and, under favorable circumstances, it is stated as low as 0.3 watts per candle-power. Three ordinary 32-candle-power incandescent lamps required as much current as a mercury vapor lamp of 750 candle-power and the efficiency is therefore more than seven times that of the incandescent lamp and about double that of the arc lamp.

As the vapor is inclosed under a vacuum there is no consumption of the light-giving element and, therefore, this type of lamp requires no trimming.

The mercury vapor lamp produces a light which is seemingly pure white, but is entirely lacking in red rays or nearly so, thus making it entirely unsuitable where the accurate determination of color values is necessary. The mercury vapor lamp operates with absolute steadiness and without noise and is said to be the most desirable form of light for factories, machine shops, and work-rooms of architects and draftsmen, as well as for all classes of photographic work.

The light of this lamp is composed to a very large extent of chemically active or actinic rays and is, therefore, a perfect substitute for daylight for all sorts of photographic processes. By the use of this lamp the studio for portrait photography may be located in any part of a building and the operator is entirely independent of weather conditions. The photographer can devote his attention entirely to the artistic arrangement of lights and shadows, as the time of exposure is constant at all times. The same equipment for the mercury-lamp skylight can be utilized for printing of all kinds with great satisfaction. The mercury lamp is of such shape that it is particularly well adapted for mechanical blue-printing with glass cylinders and revolving drums being, it is claimed, many times more efficient than the focusing arc lamp, while for photo-engraving work lamps of this type consuming eight amperes are said to do the work more quickly than arc lamps taking three times this amount of current.

Correspondence.

Ground Corn.

To the Editor of the SCIENTIFIC AMERICAN:

I beg leave to take exception to the statement made in the SCIENTIFIC AMERICAN of to-day by Mr. A. W. Dennis, that corn ground by steam will heat, whereas, if ground by water power, it will not. I know, from several years' experience as a practical miller, that *damp* grain ground by water power will heat if left in large bulk or even in as small a receptacle as a flour barrel, and that large bins full of meal from *dry* corn are safe even if ground by steam.

Worcester, Mass., July 30, 1904. W. H. DELONG.

Corn Grinding.

To the Editor of the SCIENTIFIC AMERICAN:

I noticed, in reading the article of Albert W. Dennis, on page 78 of the July 30 number of the SCIENTIFIC AMERICAN, the statement that corn ground in a grist mill that is run by steam will generate so much heat within itself, or acquire the heat in some way from the machinery, that it will burn and spoil if left in large bulk after being ground, but that corn ground in a mill operated by water will not heat itself or be affected in this way.

Mr. Dennis has been misinformed. The facts are these: Corn ground on a stone operated by water will heat and spoil just as quickly as a mill operated by steam power, and meal ground under the same conditions by water or steam will heat, if piled up, until after the grinding heat is out, then it is not safe to leave a very large amount piled up longer than a few days at a time. Meal ground on a dull stone will heat quicker than meal ground on a sharp stone. The kind of power does not make any difference with the heating of the meal, as any miller can tell him.

Macedon, N. Y., August 2, 1904. EDWIN YOUNGS.

Pressmen and Electricity.

To the Editor of the SCIENTIFIC AMERICAN:

I have read the article of Mr. A. W. Dennis, of Salem, Mass., on "Are Pressmen Affected by Electricity from a Belt?" and was much interested. I would be very glad to give him my experience and observations.

The kind of electricity spoken of is static or frictional and is the same as lightning. It is generated by the friction of two unlike non-conducting substances. Its cause in this case is the friction of the belts and pulleys, and it exists as a charge on the surface of the belt.

By consulting a standard work on electro-therapeutics, we find that static electricity is used much in treating nervous affections and that it requires care and skill to apply it so that the effects will not be injurious. There is no doubt that this treatment is beneficial to the nervous system when it is applied correctly, with reference to quality and quantity. The charge from a belt is irregular and varies constantly and we find that electricity applied in this manner injures the nervous forces. A person when subjected to the influence of a current or series of discharges for any length of time becomes numb and his breathing and pulse slow down considerably, even if the current is so mild as to cause no annoyance.

Once I had an opportunity to remedy a case of this kind in an electrical plant. The main shaft was driven by two wide belts and anyone passing near them invariably received a severe shock, which was a constant inconvenience. This discharge may be effectively prevented by running wires from any water or gas pipes in the building and fastening the ends near the belt, or they may be allowed to touch the belt. This allows a path for the discharge and proves an effective remedy.

With reference to steam and water ground corn meal, it is my impression that the difference in quality depends upon the speed in each case, which necessarily governs the friction. The machinery of a steam mill runs so fast that more heat is generated in the grain, which "kills" the grain, as millers say. On the other hand a water-driven mill operates at a lower speed and the quantity of heat generated is less. It all depends upon the speed.

Danbury, N. C. J. FRANK MARTIN.

Electricity and Lathe Work.

To the Editor of the SCIENTIFIC AMERICAN:

In reply to the interesting letter from Mr. Albert W. Dennis, published in a recent number of the SCIENTIFIC AMERICAN, I take the liberty of imparting the following bit of information:

While engaged in the manufacture of certain staple articles, about eight years ago, I had occasion to do considerable lathe work. The lathe upon which I worked had a twisted belt which was always strangely charged with static electricity, so much so in fact, that tufts of dust would cling to the leather. The belt would readily suck the oil from a spoon and wire-draw it into hair-like strings which would encircle the belt. Before this experience I had been a sufferer to a marked degree from nervousness or excessive nerve tension, but soon after I began my lathe work I felt a change for the better, though, I must admit, accompanied by a slight falling off in muscular vim. During the past year I found that after using a large Holtz static generator, with which to carry on experiments, considerable ozone was liberated. The gas would fill the room in a short time, so that my health became powerfully affected, causing pains in the thorax, and general distress, which fresh air seemed to relieve. If there are frequent discharges from Mr. Dennis' belts it is quite probable that a man working near them would in time become affected. More ventilation would be needed in the press-room, or else the press itself should be grounded. While the presence of an excess of ozone in the air, owing to its superiority to oxygen, may cause undue nervous tension and a subsequent reaction, I believe that a nervous system of ordinary tone would in time become affected and finally succumb, because of a continued form of electro-catalytic action on the highly sensitive animal tissue. ALBERT F. SHORE.

Brooklyn, N. Y., July 30, 1904.

Mosquito Extermination Again.

To the Editor of the SCIENTIFIC AMERICAN:

In a letter published in your correspondence column recently I find the following:

"No doubt if the malarial mosquito could be exterminated there would be an end to the propagation of malaria through this means, but it is not claimed, I understand, that the mosquito can, of itself, propagate the disease. It must first have had access to an infected person."

The mosquito theory as outlined above is an unproved hypothesis. It is true that the plague of mosquitoes was minimized by kerosene distribution in their breeding places, at Havana, and that yellow fever did not appear that season. But neither did it visit Santiago, Cuba, where the mosquitoes ran riot as usual. In Italy, when the "mosquito theory" started, the malarial insect was found abundantly, but no malaria existed, or *vice versa*. But, granting that there is some foundation for the theory of infection, it is evident that the insect procures its poison from the water where it was born, principally wet regions and shallow wells. If a microscopic quantity of poison from mosquito bites can produce malarial fever what must the ravage be when the polluted water is used, in large quantities, for drinking purposes?

In my opinion there is no such thing as malaria (bad air), in any habitable place. It is malaqua, not malaria, that causes the fever. I have known men and women to dwell in swamp regions, traditionally unhealthy, and maintain superb health simply by drinking pure artesian water and avoiding shallow well water. The Roman fever, in Italy, has practically vanished from the Eternal City since the establishment of new water supplies. Still blows the air of the Campagna upon Rome, but it brings no fever on its wings.

Killing, exterminating mosquitoes is a desirable thing for human comfort, but if every mosquito on earth were slain, the "malarial" (so-called) fever would continue as long as people drank polluted water and contaminated milk.

The "malarial" superstition dies hard, but it has not the potency it once possessed. Once the human mind generally understands that malaqua and not malaria is the enemy, the mosquito plays a very small fiddle in this problem. JAMES R. RANDALL.

Augusta, Ga., August 1, 1904.

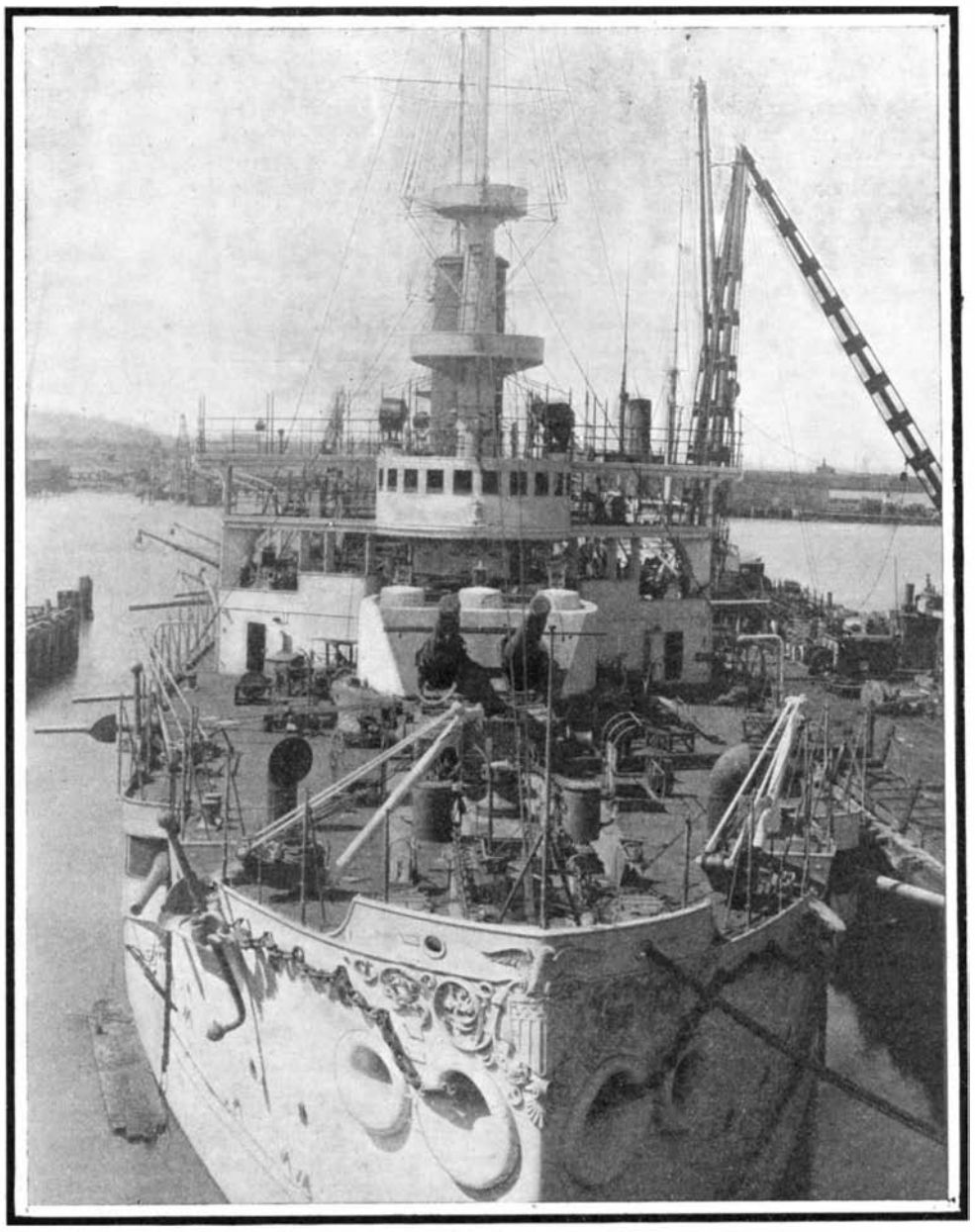
About 8,400,000 gallons of water are evaporated daily from the salt ponds in Utah when the pumps are operated ten hours a day during June and July. In August the salt harvest begins, and the yield is at the rate of 150 tons per inch per acre. Utah produces annually nearly 60,000 tons of salt.

SPEED TRIAL OF THE BATTLESHIP "OHIO."

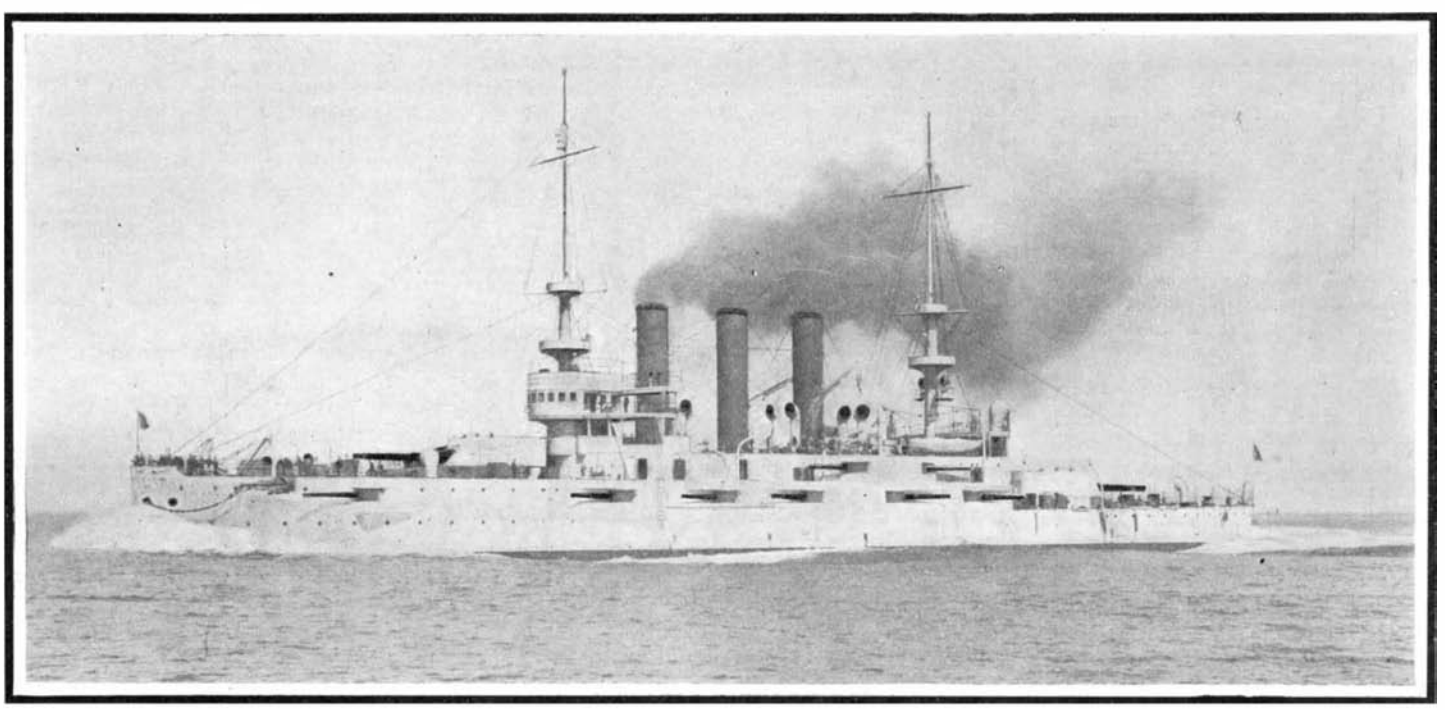
The battleship "Ohio," built by the Union Iron Works of San Francisco, received her speed trial at Santa Barbara, California, on Saturday, the 30th of July. Her actual record fell slightly below the requirements of an 18-knot speed, but it is thought probable that when allowances have been made for the tide it will be found that she made fully 18 knots and maybe a trifle more. The course lay from the Santa Barbara Lighthouse to a stake-boat 36 miles up the coast, and return. On the first leg of the course the "Ohio" fully met requirements, rounding the stake-boat with half a minute in her favor, but on the return both wind and tide were against her, and she lost a minute and a half. The trial was attended by Rear Admiral Whiting, who was the government's representative on board, and the builders were represented by Capt. Forsythe. The "Ohio" will probably be given another trial soon, when she is expected to make a better showing.

The battleship "Ohio" is one of the three powerful battleships of the "Maine" class, authorized by Congress on May 4, 1898. Although she was the first of her class to be launched (in May, 1901), she fell behind her sister ships the "Maine" and the "Missouri," which are both in commission, the former since December, 1902. The contract date of completion of the "Ohio" was originally set for June 5, 1901, so that she is over three years behind her contract.

The addition of the "Ohio" to our navy will greatly strengthen our position in the Pacific, for she belongs to the most powerful class of battleships we possess. It will be recalled that it was at first proposed to build these vessels on plans very similar to the "Alabama" class of battleships, which have a speed of about 16 knots per hour, or at least two knots below the average speed of foreign battleships. Owing to the storm of protest aroused by this proposition, it was decided to increase the speed of these vessels to 18 knots. Increased speed required the addition of twenty feet amidships to allow for the increased motive power necessary. This also made room for two more 6-inch guns in the broadside battery, and a larger coal capacity. The "Ohio" has a length of 388 feet, and a beam of 72 feet 3 inches, with a draft of 25 feet 6 inches. Her displacement when fully equipped for service and carrying her normal supply of 1,000 tons of coal will be 12,500 tons, and her full load displacement will be 13,941 tons. The normal displacement of the "Maine" is 12,300 tons, and of the "Missouri" 12,240 tons. The "Ohio," like the "Missouri," is equipped with Thornycroft boilers and twin-screw vertical triple-expansion engines. The "Maine," it will be recalled, is fitted with Niclausse boilers. The main armament of the "Ohio" consists of four 12-inch guns and sixteen 6-inch guns, and she is equipped with two submerged torpedo tubes. The armor of the "Ohio" consists of a water-line belt of Krupp steel, 11 inches thick at the top and 7½ inches at the bottom. The turrets containing the 12-inch guns have a thickness of 12 inches, and the 6-inch guns are protected by 8-inch armor. The protective deck is covered with 3-inch plate forward and 4-inch plate aft. All the joiner work above the protective deck is of fireproofed wood, and, whenever possible, light metal is used for gangways, bridges, and the like, so as to make the vessel thoroughly fireproof. The "Ohio" will have a complement of 699 officers and men.



DECK OF THE "OHIO."



THE "OHIO" MAKING SEVENTEEN AND THREE-QUARTER KNOTS.

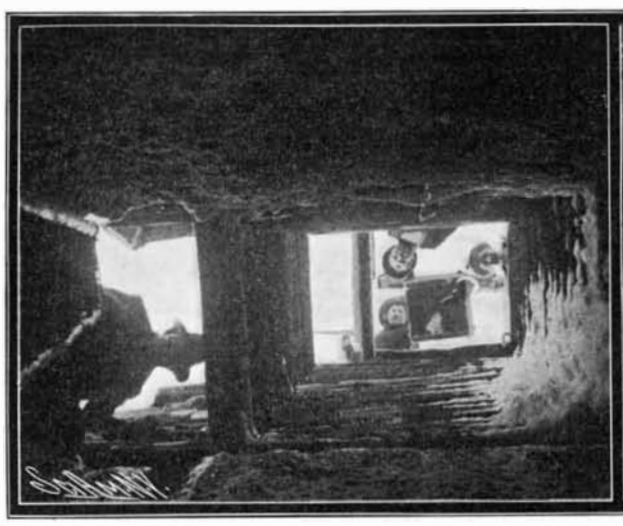
STRANGE SIGHTS IN THE FAR NORTH.

BY ARTHUR INKERSLEY.

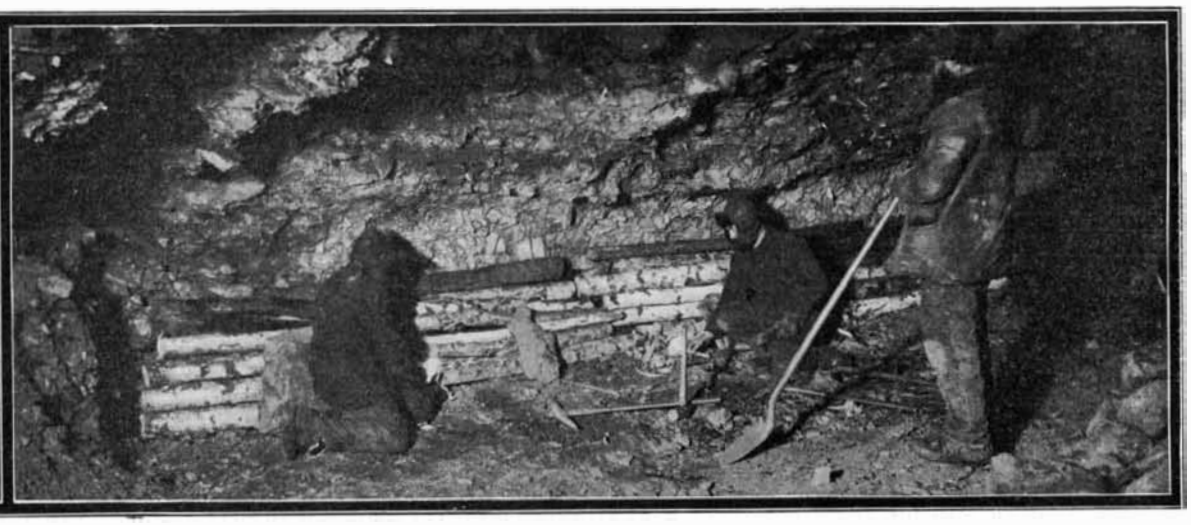
The long winter, the short summer, and the extreme cold are the conditions which are responsible for most of the strange things to be seen in the Klondike. In temperate or hot countries the process of extracting gold from a placer deposit is extremely simple—if the gold is there. A pick, a shovel, and a pan or rocker are all the implements the gold-digger needs on an Australian, South African, or Californian gold field, and, if the nuggets are large enough to be taken out by hand, the first two will suffice. But in the gold-bearing region of Alaska and the Northwest Territories, the extraction of alluvial gold is by no means so easy a process. Most of the placer deposits in that ice-bound region are in a frozen condition, and it is this fact that makes the extraction of the yellow metal there, as in Siberia, so laborious. After the miner has dug down to the depth of only one foot in many places, and in others to a depth of two feet below the surface, he strikes ground that is frozen solid and that remains so both summer and winter. Heat must be applied to soften the frozen ground before the digger can work it. "Burning down" through the frozen ground has been practiced for a long time in the gold fields of Siberia, where similar conditions exist. The process is conducted as follows: Over the prospect shaft, which generally measures three or four feet by six feet, a wood fire is made, the heat of which melts the soil to a depth of a few inches, or sometimes of a foot or more. The softened earth is shoveled out, another fire is built, and the operation is repeated until the gold-bearing stratum is removed. The fact that the material dug out of the pit must be hoisted to the surface by a buckct and windlass renders the process of sinking a shaft so slow and tedious that it taxes to the very utmost the patience and endurance of the most industrious miner. The better half of a season may be spent in "burning down" two or three prospect holes. The work is done chiefly during the winter, and the vertical prospect shafts are often united by lateral burning and picking. Not only is the work of tunneling through the frozen ground hard and tiresome, but the eager gold-seeker runs the risk of perishing, like a rat in a hole, from asphyxiation by the noxious gases generated in the process of burning. Many attempts have been made to devise a better method than wood-burning, the most successful of them being to thaw the ground by steam.

The first prospect in what seems to be a likely location is made with the gold-pan. If "colors" appear at first in small quantity and increase as bed-rock is approached, the prospector generally decides to take up the location. If a pan of the gravel when washed shows a few cents of gold, the claim is likely to turn out a valuable one. To use a gold pan properly requires some skill, the slow, rotary movement which produces the best results being very tiring to the wrist; while the rough motion adopted by some miners, either through inexperience or from a desire to make the work less fatiguing, causes the loss of some of the gold, which escapes in the washing.

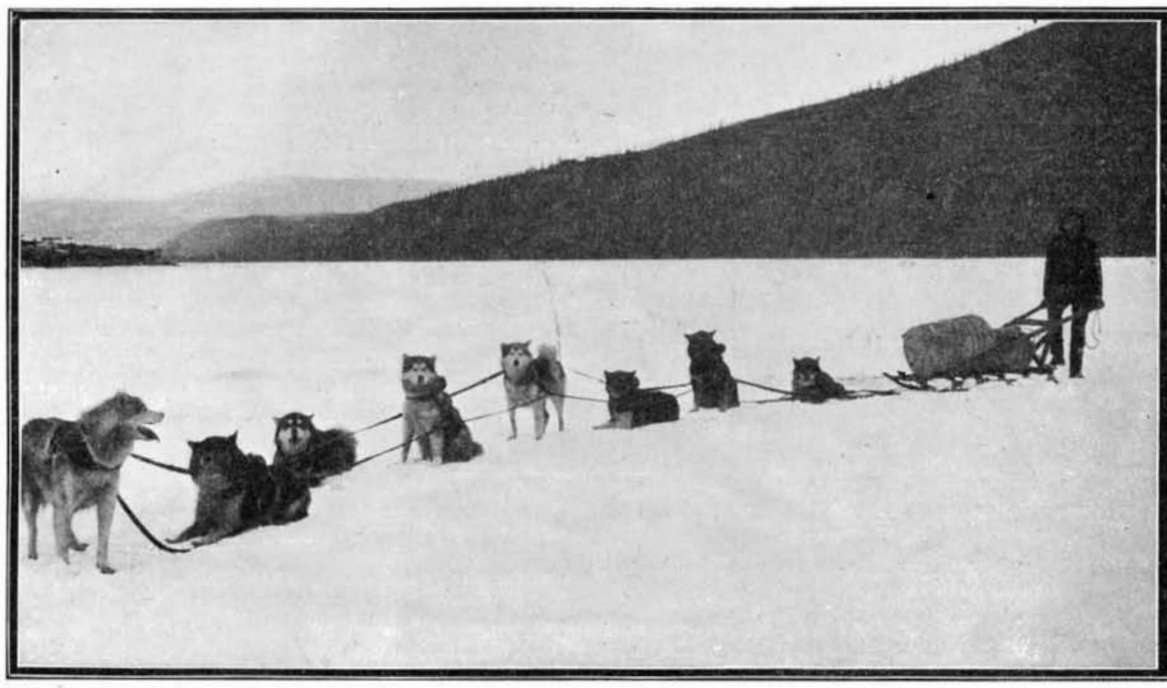
The miners, while digging prospect-holes in the Klondike region, have found from time to time bones which indicate that the animals inhabiting the Yukon region in prehistoric times were very different from those living there at the present day. In some of the creeks in the Klondike region great ivory tusks, evidently from an animal similar to the elephant or mastodon, have been discovered. The tusks vary in length from three to eight feet, some of the largest being ten to twelve inches thick. Though these remains are interesting scientifically, they are of no commercial value except as curiosities, the ivory having turned yellow from age and the long, severe frosts having cracked it so badly that it is of no use in the arts. These tusks are always found close to bedrock, buried beneath the frozen gravel at a depth of ten to sixty feet. The miners bring them up to adorn their cabins. The tusks are much curved and on the under side are worn away, giving the impression that the great animals to whom they belonged fed on moss or swamp.



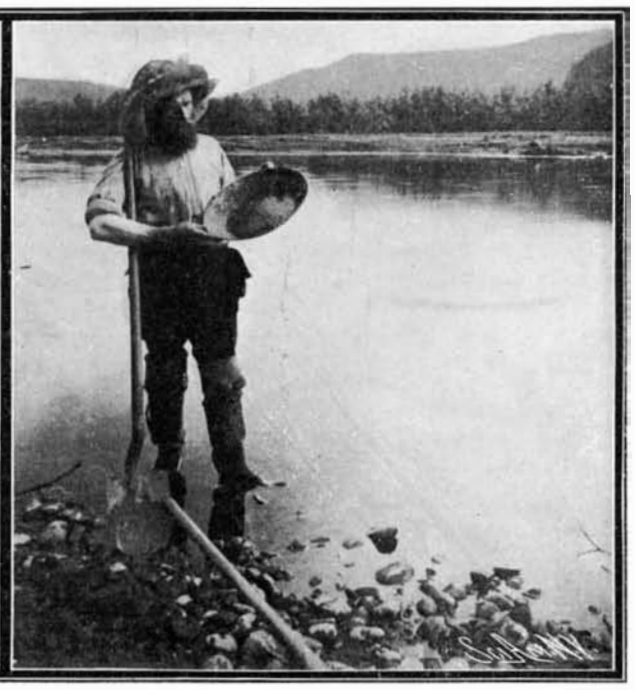
A Glimpse Down The Shaft.



"Burning-in" with a Wood Fire.



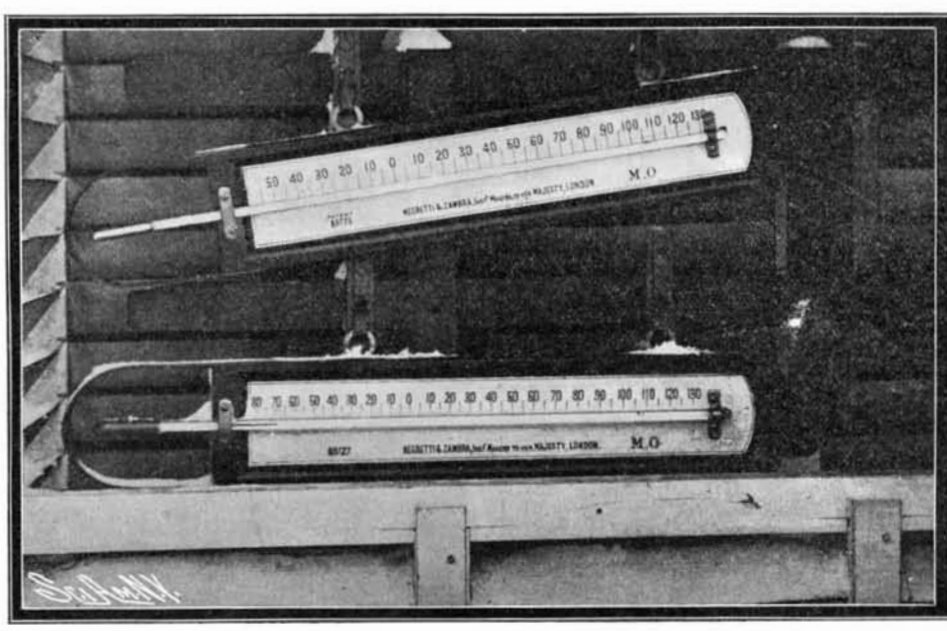
Team of Malamute Dogs and U. S. Mail Carrier on the Frozen River Yukon.



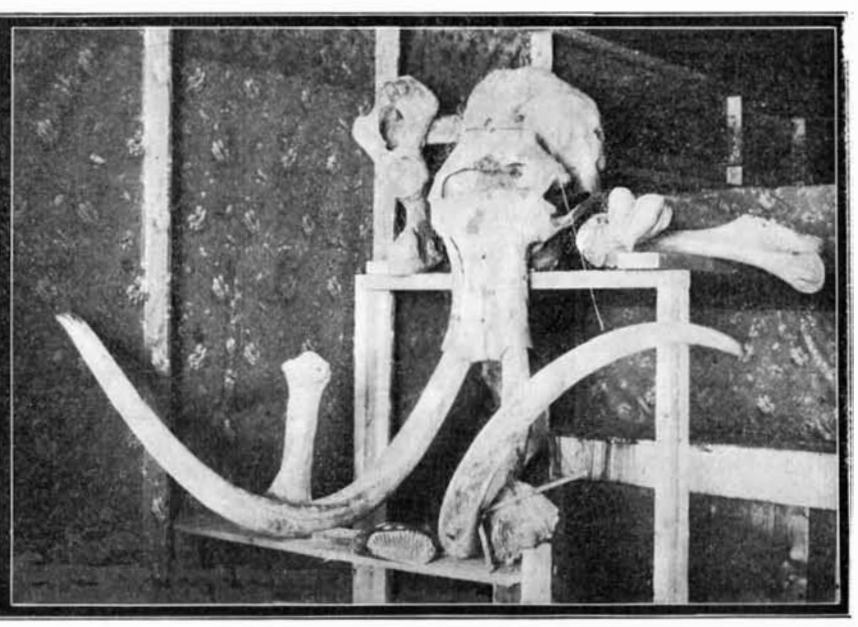
Panning Out.

"Mushing."

Prospector and His Pack Dogs.



Thermometer Registering 68 Degrees Below Zero.



Remains of a Mammoth's Skeleton.

Photos by G. G. Cantwell.

STRANGE SIGHTS IN THE FAR NORTH.

grass and that the tusks slid along the surface in front of them as they moved. The mammoth remains shown in the photograph were found in the bottom of a mining shaft, 55 feet deep, on the Hunter Creek.

During the winter, when the river is closed to navigation, the native dogs of Alaska and the Northwest Territories furnish the principal means of travel. By the aid of teams of dogs harnessed to sleds, prospectors, mail-carriers, and others have accomplished long journeys that would have been impossible without them. In the fall, when the frost has begun to bind land and water in its icy grip, the gold seekers start in to carry their winter supplies up to the mines, and for this work dogs are indispensable. Teams of five, six, or more dogs are attached to sleds and draw heavy loads over the snow or the frozen surface of the rivers. During the summer the dogs generally have an idle time, but occasionally the miners, finding themselves short of some supplies, fasten pieces of sacking on the dogs' backs and load small packs on them. The weight of the pack varies according to the size and strength of the dog and may be as little as ten pounds or as great as forty to fifty pounds. The dogs pick their way through the swamps and among the rocks, showing by their carefulness that they are quite aware of the damage a bad fall might do to their packs. During the working season the dogs are fed on dried fish, the Indians near the mines doing quite a good business in summer catching salmon and drying it for use during the following winter. The price of salmon varies from about ten cents to a dollar per fish. A dog under ordinary circumstances eats two pounds of salmon per day, but if the fish cannot be obtained, is fed on bacon and rice cooked together, of which three to four pounds are required to feed him each day. It is the custom to feed the dogs only once during the twenty-four hours, and at night, as a dog, after he has been fed, becomes disinclined to work. Some few miners, kindlier than the rest, give each dog a small piece of fish at noon, but most men feed them only at night, giving them all they can eat at that time.

Specially-constructed instruments are necessary to register the extremely low temperatures of winter in the Far North, the ordinary mercurial thermometer becoming useless at 40 deg. below zero, as the mercury freezes at that temperature. In the early days of Dawson the only trustworthy thermometers in the camp were the property of the captain of the Northwest Mounted Police at the barracks. They were manufactured especially for recording very low temperatures. The minimum temperature registered during the winter of 1897-8 was 72 deg. below zero in a rather exposed place on the Klondike River, where the cold is some degrees greater than in the city of Dawson. Only one of the two thermometers shown in the accompanying photograph is capable of registering the temperature of 68 deg. below zero shown by it. In the other the spirit, disgusted at the extremely low temperature, has retired into its bulb, not to emerge for business again until the temperature shall have had the decency to rise to 60 deg. or 55 deg. below zero. The photograph was taken in Dawson on January 15, 1901.

Clearing Out Space.

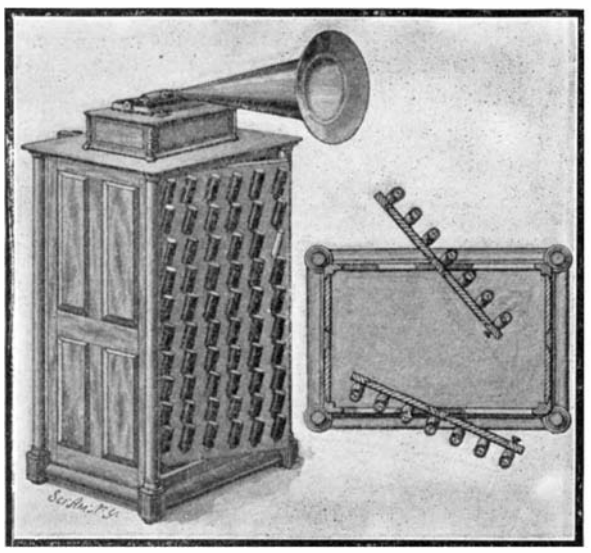
BY EDGAR L. LARKIN.

With a parallax of 0.021 sec. for the star Antares, as given by Sir David Gill, its distance in round numbers is one quadrillion miles. From photometric considerations. J. E. Gore, SCIENTIFIC AMERICAN SUPPLEMENT, No. 1474, page 23622, computes the mass to be 88,000 times that of our sun. An incredible quantity of matter must therefore have been drawn in from all adjacent space to build up its giant mass. This space should be, in the nature of the case, comparatively clear of matter. The fact is, that a wide region north of Antares, extending from northeast to northwest, for quite a distance, is about as void of stars as any known to the telescopist. With the 16-inch glass in this observatory, focal length 22 feet, and with a power of 200, many starless fields are encountered, and several with a wide eye-piece of power 132. These blackened and waste areas show no stars; or if any, they are at the extreme limit of vision in this splendid and pure mountain air. And in these dark expanses no trace of the delicate, pearl-white, shimmering background of the sidereal structure can be seen. Space is swept clean. The inference may be made that all the matter once in this wide area has been drawn in to build up the colossal sun Antares. And as that star is now in a region where there are others, a further deduction is possible, namely, that since formation, Antares has drifted southward. Sagittarius and Scorpio present many black fields without either star or the nebulous background which lies beyond the entire visible universe except in these dark openings, deeps, or caverns. There are at least one hundred starless fields in these constellations. One typical and most beautiful example is in right ascension, 18 h., and south declination 27 deg. 54 min. It is jet-black as seen here. The edges of the sidereal cistern are clear-cut, as though dug in glittering sand. To the east is a circle of small stars, in an intensely rich region. A theory is possible that the cluster of suns formed where the cavity now is, and then moved toward the east. Whether the shining base, or substratum of the entire sidereal structure is made up of quadrillions of suns, or whether the whole universe is immersed in nebulous matter, may never be decided. But the marvelous object is always visible in its majestic splendor, when the moon is absent. All nature is enshrouded in a cloth of pearl, except where these rents appear.

Lowe Observatory, Echo Mountain, California.

CABINET FOR STORING PHONOGRAPH RECORDS.

Phonograph records being ordinarily made of wax, are very fragile and must be preserved with consider-

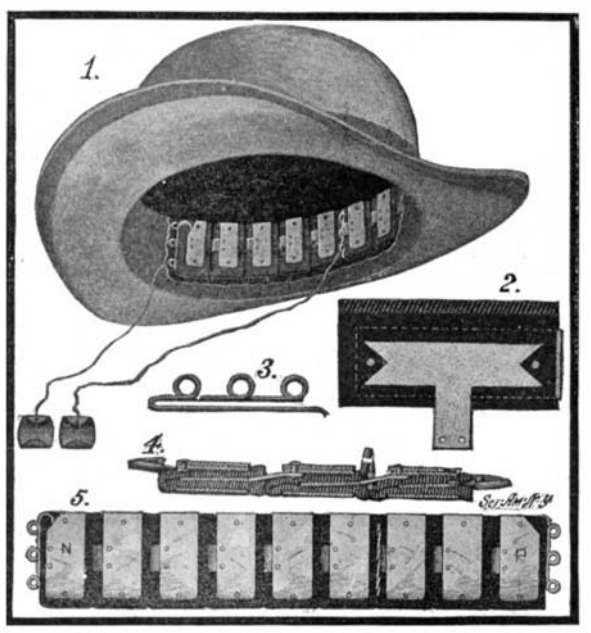


CABINET FOR STORING PHONOGRAPH RECORDS.

able care, and when many are to be provided for it becomes a matter of difficulty to do this and at the same time have them accessible for ready selection. We show herewith a cabinet invented by Mr. Edgar Krom, of 538 West 159th Street, New York city, which provides for the safe keeping of a large number of records. The cabinet is formed with two swinging doors pivoted centrally at the top and bottom. The inner face of each door is provided with a number of pins upwardly inclined, on which the records are supported. On the upper end of each pin is printed or written the name of the particular record thereon supported. The cabinet is preferably of such height as to furnish a convenient support for the phonograph. In use the cabinet will be preferably placed at sufficient distance from the walls of the room to permit swinging of either door upon its central pivots. When the doors are thus opened, all the pins and supported records may be seen, and any of the latter desired may be removed without disturbing the others. It will be seen that this cabinet provides for the storing of a great number of records in a comparatively small space, renders each freely accessible, and does away with any danger of injuring the one removed or those about it. At the same time it is comparatively inexpensive to construct, and furnishes an ornamental and convenient support for the instrument in connection with which the record is to be used.

MEDICAL BATTERY.

A convenient form of medical battery has recently been invented by George Francis Webb, M. D., of Geneva, Ohio, which may be conveniently carried about one's person. As an example of its convenient form we have shown the battery as carried within the sweatband of a hat. The battery cells are each made up of a strip of felt or flannel folded over on itself and enveloping a copper plate which forms the negative element of the battery; the positive element consists of a U-shaped zinc band which is slipped over the felt strip. A strengthening plate, also of zinc, is fitted under the upper arm of the U-shaped band, and together the two zinc strips are securely riveted to the felt strip. The copper plate is formed with a projecting stem as shown in Fig. 2, and in connecting up the cells of the battery this is bent up and riveted to the upper arm of the next cell of the series. Instead of binding-posts at each end of the battery, the inventor uses wire clips such as that shown in Fig. 3. The wire is bent to a U-shape with loops formed on one of the arms. The straight arm is fitted between the felt and the copper or zinc plate as the case may be, and wires are attached to the loops which also serve as handles for readily manipulating the device. Electrodes of the form shown are secured to the ends of the wires. They are made of aluminium, the metal being frosted so as to distribute the effect and also to present a neat appearance. In use the felt strips are saturated with a corrosive solution such, for instance, as salt water or water containing a small proportion of sulphuric acid. The current set up by the chemical action of the corrosive solution on the metal plates may then be conducted by means of the electrodes through the diseased organ or part. To increase or diminish the electromotive force it is not necessary to disengage the wire, for the wire clip may be moved into engagement with any one of the stems of the copper plate, as indicated by Figs. 1 and 4.



MEDICAL BATTERY.

Calcareous Bricks in Germany.

There are as yet no factories for the production of sand-lime bricks within the limits of this district, though many have been erected in Germany within the past few years. There does not seem to have been uniform success in the production of sand-lime bricks in Germany. In a recent number of the Thonindustrie-Zeitung reasons for this non-success are freely discussed, and may be summarized as follows:

So many plants have been suddenly erected that bad results have grown out of the lack of proper experience in handling, rather than out of defective equipment. The main causes for defective products are inexperience in slacking lime and in mixing the mortar. Good white lime and clean, sharp sand are necessary for good results. The product is rarely spoiled in the mere pressing and drying. Naturally that brick will be best which is pressed the hardest, but the customary presses are entirely adequate; hence, the two reasons above assigned alone remain. In handling sand-lime bricks one frequently finds in them clods of clay the size of a filbert that naturally destroy their value, which depends upon so perfect a mixture that no lumps remain and every grain of sand has its coating of lime. Imperfectly slacked lime is even more detrimental. The process of slacking greatly increases the volume of the article, and if insufficient water be added in the process, absorption of moisture from the atmosphere takes place after the brick is made, expanding it and causing seams or cracks in it. Such cracks may be too small for ordinary detection, yet the defect is nevertheless a serious one. It is best to use in slacking, sufficient water to produce a soft, mushy powder, damp enough to admit of balling, but the plan of allowing the mixture to rest in the bed for at least twenty-four hours, instead of at once feeding it to the press, is the safest. Little differences in composition are thus equalized and the mixture becomes more pliable and plastic.—Hugo Muench, Consul at Plauen, Germany.

The Current Supplement.

The current SUPPLEMENT, No. 1493, opens with the conclusion of Emile Guarini's article on the electrometallurgy of iron and steel. Many illustrations of plants actually in operation accompany the text. Mr. William R. Hill, formerly engineer of the Aqueduct Commission of New York, tells something of the modifications of the plans in the new Croton Dam. Dr. Wiley's exhaustive paper on the results of his borax experiments is concluded. Mr. E. A. S. Whitford describes a new design of reinforcement for concrete steel girders. The St. Louis Exposition is represented in the number by two articles of widely different nature, the one on the Tyrolean Alps, the other on the Curtis steam turbine. Both articles were prepared by a representative of the SCIENTIFIC AMERICAN at the fair. "The Chemistry of Cottage Cheese" is the title which Mr. F. H. Hall has selected for a very instructive article. Mr. Charles H. Stevenson, whose articles on the aquatic industries have doubtless attracted no little attention, writes on oil from the livers of sharks and related species, and on beaver furs. T. H. Blakesley, M.A., in an article on direct-vision spectroscopes, writes in a scientific vein. His article will doubtless be appreciated at its true worth by students of chemical physics. The succession of changes in radio-active bodies is made the subject of some comment.

A MARVELOUS AUTOMOBILE RECORD—103½ MILES AN HOUR.

Decidedly extremes met when the third day of the Ostend automobile week commenced with a race from Bruges, that old-fashioned, sleepy, historic town, which seems to represent everything that is slow and long established. The spectacle of the invasion of motor-cars, rushing and puffing in the streets of this calm and ancient city of the past, seemed highly incongruous. The race started from Bruges, and the route to be followed ran to Blankenberghe and back. It was a trial for touring cars, and thirty competitors presented themselves. The road, although paved, is good, and the same route was taken for the return—the "*route de pierre*" as it is called in the country. It passes through a silent, melancholy district intersected by the green waters of slow canals, and interspersed with windmills..

The following account of the Ostend events and the accompanying illustration are from the Car:

A MARVELOUS FEAT: RIGOLLY TRAVELING AT THE RATE OF 103½ MILES AN HOUR.

The great event was the mile with a standing start, where it was confidently expected that records in all the classes would fall. The cars had been carefully tuned up, and everything was in their favor.

This race was open not only for the five categories of racing vehicles, but also for seven categories of touring cars, according to the price of the chassis. The day opened hot as usual, with a strong northeast wind which helped the competitors, and the result of the day's racing was very remarkable. Records fell rapidly, and everything existing in this direction was quite wiped out. Not only were the records officially beaten, but from calculations made on the spot, for the last 600 meters of the mile tremendous speeds were reached. It is estimated that the cars traveled up to 160 kilometers (100 miles) an hour. The Darracq cars were the favorites of the day, and it is to them that the victory fell in the voiturette class, as well as in the class for the heavy cars.

Mile, Standing Start.

A.—Motor Bicycles.—1, Olieslagers (Minerva), 59 2-5s. (world's record); 2, Seguy (Griffon), 1m. 6 2-5s.; 3, Coppin (Red Star), 1m. 16 2-5s.

B.—Motor Cycles.—1, Rigal (Buchet), 1m. 16 1-5s.; 2, Pillette (De Dion-Bouton), 1m. 18s.

C.—Voiturettes.—1, Edmond (Darracq), 1m. 1 4-5s. (world's record).

D.—Light Cars.—1, Hanriot (Bayard), 56s. (world's record).

E.—Cars.—1, Baras (Darracq), 48 3-5s. (world's record; 2, Rigolly (Gobron-Brillié), 50 1-5s.; 3, Le Blon (Hotchkiss), 1m. 22s.

Touring Cars.

A. (chassis of less than 4,000 francs).—1, Gachet (Boyer), 2m. 4 3-5s.

B. (less than 6,000 francs).—1, Fischer (Vivinus), 1m. 27 3-5s.; 2, Gabreau (Boyer), 1m. 34 4-5s.; 3, De Liedekerke (Vivinus), 1m. 37 2-5s.

C. (less than 10,000 francs).—1, Landrin (Serpollet), 1m. 30s.; 2, De Breyne (Darracq), 1m. 33 3-5s.; 3, Poncelet (Vivinus), 1m. 37s.

D. (less than 15,000 francs).—1, Laminne (Rochet-Schneider), 1m. 18s.; 2, Finet (Rochet-Schneider), 1m. 19 3-5s.; 3, Grégorius (Rochet-Schneider), 1m. 23 2-5s.

E. (less than 20,000 francs).—1, Gaste (Automotrice), 1m. 47 2-5s.; 2, Mahieu (Automotrice), 1m. 58 1-5s.; 3, Cordonnier (Mors), 2m. 12s.

F. (less than 30,000 francs).—1, Delesalle (C. G. V.), 1m. 40 4-5s.

G. (more than 30,000 francs).—1, De Caters (Mercedes), 1m. 3-5s.; 2, De Jochems (Mercedes), 1m. 10 3-5s.

The interesting part of the Ostend meeting from a racing point of view came to an end with the flying kilometer, which took place between Ostend and the bridge of Snaaskerke. The principal event was the last round of the struggle between Rigolly and Baras, who were so close together in the other speed competitions. There were, indeed, only three competitors in the heavy-car class, Le Blon on a Hotchkiss being the third. In point of view of speed the Ostend race wipes out all existing records, and the victory of Rigolly, who covered the flying kilometer in 21 3-5 sec. at a speed of 166 kilometers, 666 meters an hour (that is to say, 103½ miles per hour) upsets all calculations of wind resistance and leaves one to wonder to what fantastic figure automobile speed will take us.

Baras was not far behind Rigolly, for his Darracq accomplished the distance in 22 sec., while Le Blon, who is gradually getting his Hotchkiss tuned up, covered the kilometer in 25 1-5 sec. In the other classes the only record was obtained by Edmond on a Darracq voiturette, who covered the distance in 30 2-5 sec. Following is the result of the different classes:

The Flying Kilometer.

(1,000 Kilos. Class).—1, Rigolly (Gobron-Brillié), 21 3-5s.; 2, Baras (Darracq), 22s.; 3, Le Blon (Hotchkiss), 25 1-5s.

(Light Cars.)—1, Hanriot (Bayard), 26 4-5s.

Voiturettes.—1, Edmond (Darracq), 30 2-5s.

Motor Tricycles.—1, Rigal (Buchet), 12m. 35 2-5s. He finished by pushing his machine.

Motor Bicycles.—1, Seguy (Griffon), 36 2-5s.; 2, Coppin (Red Star), 40 4-5s.; 3, René (Red Star), 45 3-5s.

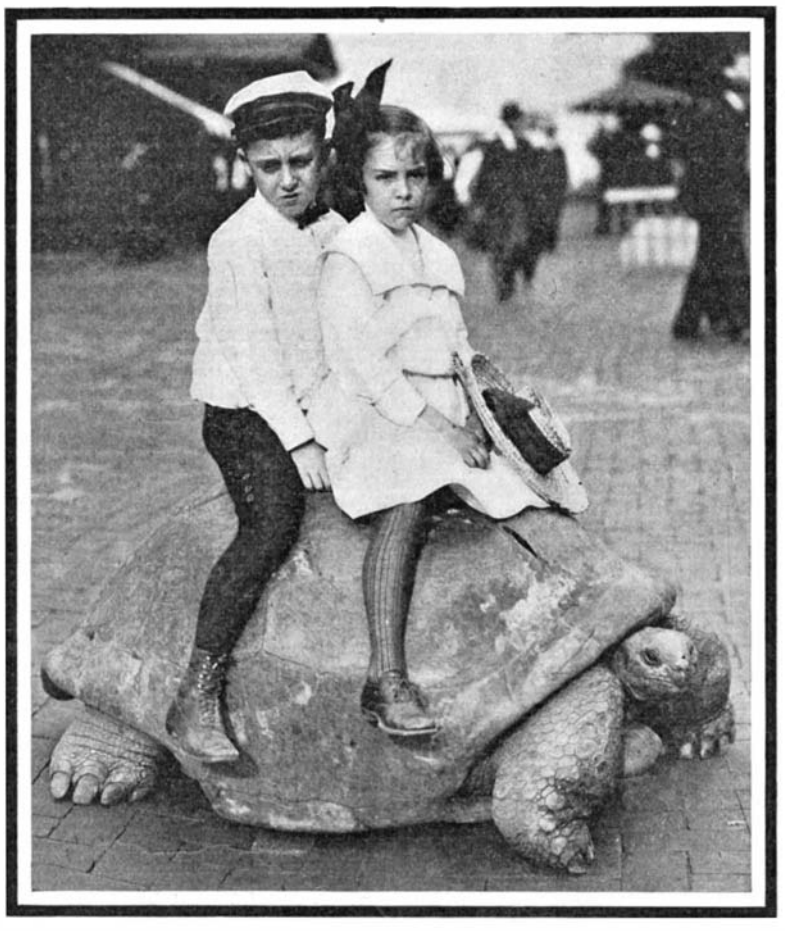
Tourists' Section.

Chassis less than £240.—1, Gabreau (Boyer), 49 3-5s.; 2, Fischer (Vivinus), 50s.; 3, Trentelivres (Vivinus), 50 4-5s.

Chassis less than £400.—1, Landrin (Serpollet), 40 2-5s.; 2, Homback (Vivinus,), 49s.; 3, Poncelot (Vivinus), 49 4-5s.

Chassis less than £800.—1, Deville (Serpollet), 40 3-5s.; 2, Mulders (Fiat), 44 2-5s.; 3, Cordonnier (Mors), 46 1-5s.

Chassis less than £1,200.—Delesalle (C. G. V.), 50s.



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GIANT TORTOISE WHO WEIGHS 970 LBS. AND IS REPUTED TO BE 300 YEARS OLD. HE CAN EASILY CARRY TWO FULL-GROWN MEN.

Chassis more than £1,200.—1, De Caters (Mercedes), 30s.; 2, De Jochems (Mercedes), 35s.

Copper smelting was attempted in this country as early as 1650, but the real inception of the industry dates from 1845, when Lake copper first appeared on the market. In the latter year, also, smelting works were erected at Boston and Baltimore to treat ores imported from Chile and Cuba.

THE OLDEST KNOWN INHABITANT OF THE GLOBE.

BY THE ST. LOUIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

Several years ago, when the son-in-law of Karl Hagenbeck, the animal trainer, was looking for interesting specimens, he learned of the existence on the island of Seychelles, off the coast of Madagascar, of a giant tortoise, that was celebrated among the natives not merely for its great size—it weighs 970 pounds—but for the fact that there was documentary evidence that it had been living on the earth for over 150 years and probable evidence that it was from 100 to 150 years older than that. After careful investigation, he was satisfied of the truth of the statement, and set about to secure the loan of this animal (which, by the way, is held in the highest esteem and respect on the island), for exhibition at the St. Louis World's Fair. Not until the strongest assurances were made that the venerable curiosity would be returned to the Seychelles did the native population consent to part with him for his long vacation. We are informed by Mr. Hagenbeck that when the tortoise reached this country, it was found that a tiny palm tree was growing from the back of the creature. The tortoise loves the mud, and it is evident that soil was washed into a deep scar on his back and that the seeds of the palm, mixed with the earth, took root and the tiny growth had thrived in its portable field.

The tortoise is the longest-lived animal, exceeding even the elephant, which frequently exceeds one hundrd years of life. The fact that 150 years ago the Seychelle natives began to take particular pride in this tortoise because of its age makes it certain that it must have been at least one hundred years of age at that time. This is borne out by the condition of the shell, which is a guide to determining the age. Further evidence is its most abnormal size.

It possesses extraordinary lifting strength. While it was in its heavy cage at the World's Fair express office, it became impatient, and proceeded to break its way out. It smashed the heavy 2 by 8 inch timbers with ease. The accompanying snapshot shows two children taking a novel ride upon the back of this giant sea monster.

At Chu-Yung, in Mongolia, exists a wonderful set of inscriptions, recalling the Rossetta stone of Egypt. It was found on the marble archway which was erected in 1345. The arch is of white marble fashioned to form a ceiling of three plain surfaces, on which Buddhistic figures are carved in relief. The walls are covered with similar carvings, and with inscriptions in six languages. Five of the languages are Sanskrit, Chinese, Tibetan, Mongol, and Uigur respectively; the origin of the sixth remains unknown. It was considered at first to be Juchen, the national script of the Chin, or Gold Dynasty, who followed the Kitans as the dominant power in North China in the early part of the twelfth century, but the few specimens of Juchen writing extant did not coincide with it. Dr. S. W. Bushell, the physician of the British Legation at Peking, however, has identified the sixth language as a Tangut script, of which few specimens are existent. This writing was adopted in 1036 by Yuan Hao, the founder of the Tangut kingdom, and was apparently modeled on the lines of the antique Chinese official script. The Chu-Yung Kuan gateway and a stone stele in a Buddhist monastery are the only two considerable examples of the Tangut script which are known to exist.

The scenic tunnel, under the Horseshoe Falls of Niagara, which has just been completed, was undertaken for the Niagara Falls Queen Victoria Park Commission in order to provide a perfectly safe view of the cataract from below. A shaft was sunk 127 feet and from this a tunnel was constructed, curving out under the Horseshoe Falls 800 feet. From this laterals were run into the gorge, where large observation-rooms will be constructed of glass where tourists can sit in easy chairs and look out. A large electric elevator has been put into the shaft, and from the bottom a large board walk has been constructed to the mouths of the various tunnels.

RECENTLY PATENTED INVENTIONS.

Of Interest to Farmers.

LOADING DEVICE.—J. P. FOSTER, London, Ohio. Although capable of many uses this device may be described as applied to the loading of corn on wagons. In many parts corn after husking is thrown on the ground and when the wagons come along to receive it has to be picked up by hand and thrown over the sides of the wagon. The object is to do away with this laborious, slow process. This is accomplished by means of an improved device designed to be applied to a wagon and to be used with sacks for holding corn or other material.

Of General Interest.

PUZZLE.—M. N. STRICKLAND, Galveston, Texas. In this patent the invention pertains to improvements in puzzles of that class in which the rolling device is to be moved from the starting-point to a finishing-point, there being barriers or obstacles to the movement of the rolling device. The object is to provide a puzzle that will be difficult to solve and prove entertaining.

QUOIN.—W. V. CROCKETT, Corsicana, Texas. The invention relates to improvements in quoins for locking type-forms; and the object is to provide bearing-plates in connection with the wedges so connected that by the sliding movement of the wedges the plates will be spread apart without lengthwise movement, thus preventing any movement or displacement of the type, as sometimes happens when a wedge engages directly therewith.

VENTILATOR FOR HATS, ETC.—J. P. MARTIN, Ogden, Utah. In this instance the invention refers to ventilators, and more particularly to those adapted for application to hats or such structures as tents. Its principal objects are to provide such a device which while easy to apply will provide an effective and readily-controllable supply of fresh air and simultaneously remove that heated or vitiated.

CABINET.—E. KROM, New York, N. Y. More especially this invention relates to cabinets adapted for the storing of such cylindrical objects as phonograph records. These records being of wax are fragile and must be preserved with considerable care, and when many are to be provided for it becomes a matter of difficulty to do this and at the same time have them accessible for ready selection. This cabinet obviates these difficulties.

SNATCH-BLOCK.—J. E. GILCHRIST, Southbend, Wash. In this patent the invention has reference to snatch-blocks, and more particularly to those designed for use in logging. Its principal objects are to provide such a device which will be both light and strong and which will prevent the coacting cable from fouling or straining the shell of the block.

SAP-SPOUT AND COVER.—G. H. GRIMM, Rutland, Vt. The inventor provides a spout and cover for the bucket into which sap runs from the spout, the arrangement being such that the spout insures free flow of sap from the bore, and the cover rises sufficiently on tipping the bucket to allow of emptying it without removal from the supporting-hook and without the operator being required to manipulate the cover, and the cover protects contents against rain, snow, leaves, and the like, and is firmly supported from the spout and can be readily swung into open position to allow of inspection, and is not liable to be detached by strong gusts of wind.

TABLE.—F. G. DYER, Eastport, Maine. To accomplish using this table as a card or similar table or which may be so adjusted as to form the moving part of a self-waiting dining-table, the inventor provides a base and a top with a column removably connected to each, the top and base being capable of direct rotatable connection. With this equipment the table may be assembled in the usual manner and used as a table proper, or the column removed from base and top directly joined, whereupon base and top may be placed in center of dining-table to form a self-waiter therefor.

SEAT-PROTECTOR FOR CHILDREN'S DRAWERS.—DOROTHY B. CHAMBERLAIN, Fort D. A. Russell, Wyoming. The object of the invention is to provide an inexpensive shield of combined waterproof and warm fibrous material that is neat in appearance, readily attached upon or removed from the drawers, which affords perfect protection from dampness when sitting upon wet grass or ground, which will not interfere with other underwear or the outer dress, will remain invisible, and that at all times permits utmost freedom for the wearer's lower limbs.

GAGE.—H. S. GARDINER, Amsterdam, N. Y. In this patent the invention has reference to measuring instruments; and its object is the provision of a new and improved gage, more especially designed for conveniently and quickly determining the sizes of twist-drills and other objects, and to gage wires and the like.

HAME-FASTENER.—S. T. MARLETTE, Buffalo, N. Y. Mr. Marlette's invention belongs to that class of fasteners in which there are two hook members adapted to be connected to the loops at the lower ends of the hames and a lever connected to these hook members, so that when the lever is turned, it will draw the hook members and the ends of the hames together, the lever being provided with a latch to hold the hook members in the locked position.

VIOLIN.—J. D. LOPPENTIEN, Orange, Cal. In this patent the invention relates to stringed musical instruments—such as violins, cellos, and the like—having strings played on by the use of a bow. The object is to provide a violin arranged to insure the production of a full, harmonious tone when the strings are sounded by the bow.

Hydraulics.

HYDRAULIC PRESS.—E. CROWE, Birchholm, Bushey Wood, Totley Rise, Sheffield, England. This invention relates to means used for forging and other purposes—such as bending and testing armor-plates, flanging, and the like; and its objects are to enable valves controlling press action to be worked directly and promptly by hand without necessity of using auxiliary hydraulic or other fluid-pressure independent of that whereby the press-head itself is operated, and to enable the speed of descent of the head on to the work to be regulated at will and the head arrested at any point in descent. It is an improvement on the invention for which Mr. Crowe made previous application for Letters Patent.

Machines and Mechanical Devices.

COMPRESSOR.—I. CARLIER, Denver, Col. Mr. Carlier's invention has reference to improvements in compressors and has particular application to a device of this character for compressing air through the agency of a liquid or fluid. One of the principal objects is to construct a compressor which shall be exceedingly simple in its construction, positive in its operation, and capable of withstanding a maximum amount of wear and tear.

RIVET-MAKING MACHINE.—C. W. RICHARDS, Cleveland, Ohio. In this patent the invention relates to a machine for automatically forming headed rivets from a continuous bar of iron, and one of the leading features of the invention lies in the provision of a stationary rivet-head die and a moving plunger which operates toward and from the die, carrying the rivet-blank to the die and withdrawing the rivet upon the completion of the formation thereof.

ICE-CUTTING MACHINE.—R. MOWERY, Hot Springs, Ark. Mr. Mowery's object is to provide an improved cutting-machine more especially designed for cutting blocks of ice into small pieces for use in hotels and other establishments and arranged to allow convenient and quick handling of the block during the cutting operation.

MACHINE FOR MAKING CIGARETTE-TUBES.—J. C. HANSEN-ELLEHAMMER, 99 Istedgade, Copenhagen, Denmark. The inventor aims to avoid intermediate stages between the tube-making and tube-filling device, which is obtained by making the filling device movable upward or sidewise and capable of placing the tube simultaneously with the folding of the paper direct on to the outlet-spout of the filling device. Means are provided to leave the paper tube free on the spout. The tube is filled and removed, and the tube-making device is moved back to first position ready for the next cigar ette. This arrangement may be used for tubes whose edges are connected by folding, as well as those stuck by an agglutinant.

REVOLVING-HOOK SEWING-MACHINE.—P. ANSCHUTZ, New York, N. Y. The object of the invention is to provide a revolving-hook sewing-machine which is simple and durable in construction, very effective in operation, and arranged to insure the formation of a uniform lock-stitch in a simple manner without danger of missing stitches.

STREET-CLEANER.—J. J. SMITH, Joliet, Ill. In this case the purpose is to provide a cleaner arranged to free the street of all dirt, litter, and the like, by the use of jets of water under pressure and directed in such manner as to wash the dirt, etc., into a curb or gutter, from which it can readily flow to the sewer or other place of discharge, or can be gathered in heaps, if desired.

MULTIPLE-SPINDLE BORING-MACHINE.—C. SEYMOUR, Defiance, Ohio. Mr. Seymour's object is to provide a multiple-spindle boring-machine arranged to permit a convenient adjustment of the boring-tools relative to the work, to bore a number of holes simultaneously and in a desired predetermined order, and to allow adjustment of the work-carrying table relative to the boring-tools to bore holes of a desired depth without varying the throw of the work-carrying table.

PLAITING ATTACHMENT FOR SEWING-MACHINES.—O. RICKENMANN, New York, N. Y. In carrying out the present improvement the inventor has in view the construction of an attachment which shall feed to the needle or sewing machanism of the machine a strip or tape of suitable material and shall automatically form the same into plaits or ruffles, the present invention being especially designed for the making of plaits of the character commonly known as "box-plaits."

DRIVING DEVICE FOR MUSIC-SHEETS.—H. MEYER, New York, N. Y. In this patent the invention relates to automatic piano-players and like musical instruments; and its object is to provide a new and improved driving device for the music-sheet of a musical instrument arranged to insure a uniform even travel of the sheet in a very simple manner.

TYPE-WRITING MACHINE.—J. D. WHITE, 50 Clanricarde Gardens, London, England. The objects of Mr. White are to provide a machine in which as character after character is struck the printing passes along from left to right without corresponding lateral movement of the types or converse lateral movement of the paper, and in which, as the characters are printed in continuous succession, line after line is printed in sequence, the new line commencing after the previous one is completed, without special movement or attention of the operator. For this purpose he uses, combined with other mechanism, a type-cylinder and hammer-cylinder resembling those described in his former United States patent.

MACHINE FOR MAKING VEGETABLE HAIR.—W. HANSON, Fort Myers, Fla. Mr. Hanson's invention pertains to improvements in machines for making vegetable hair, the object being to provide a machine of this character by means of which the product may be rapidly formed from the fans of certain kinds of palm or palmetto which grow wild and in vast abundance in Florida and elsewhere.

TRANSMITTING MECHANISM.—J. J. KOOMAN, New York, N. Y. In this patent the improvement refers to a gearing which may be used for the mechanical transmission of power for all purposes. It is not limited in its application, as the invention may be applied to bicycles, engines, manual powers, and for any other purpose requiring the mechanical transmission of motion.

Medical Devices.

DENTAL DUCT APPLIANCE.—F. P. ABBOTT, New York, N. Y. The inventor employs a cushion-pad to the interior of the mouth over the sublingual ducts, through which saliva is supplied, the pad associated with means for pressing it in place, so as to choke off the saliva flow. The pressure device employed contemplates a form of compress which has a rest to be applied to the jaw in a position to co-operate with the mouth-pad, and this compress also includes means by which the parts may be operated quickly and to secure nicety and accuracy, to the end that the appliance may be used without hurting the patient and quickly dismounted as the needs of service require.

APPARATUS FOR HEATING AIR.—F. T. BRENNER, Quincy, Ill. One of the principal objects of the invention is to provide an apparatus through the medium of which air may be readily, easily, and quickly heated and conducted in puffs or jets to the middle ear for the treatment of the auricular nerves. The apparatus is conveniently manipulated, occupies little space, and may be manufactured at little expense.

Railways and Their Accessories.

CAR-BUMPER.—E. MORAN, Charleston, W. Va. The chief object in this case is to provide bumpers which will remain engaged when cars are moved from the rear and are passing around a curve, in which case under certain conditions—as, when a series of cars are loaded or train very long—a strong lateral pressure is applied and there is extreme danger of derailment of one or more cars. Each car at opposite ends is provided with bumpers of different construction, corresponding with bumpers of other cars, so that they are adapted to engage and lock.

CAR-DUMP.—E. MORAN, Charleston, W. Va. Mr. Moran's object is to provide a dump for mining-cars, same including track running from the mine at down grade to the dump proper and return-track from dump to mine also down grade. A car leaving a mine runs by gravity to the dump, contents are discharged and returns by gravity. The dump is so constructed that it is held normally elevated or at rearward inclination and depressed by loaded car, and when the latter's contents are discharged the dump is automatically raised, so that the car runs back off the same by gravity, and passes on to the return-track.

METHOD OF AND MEANS FOR ENABLING BRAKES TO BE APPLIED TO OR RETRACTED FROM EITHER SIDE OF RAILWAY-VEHICLES.—F. W. GASMIER, 2 Victoria Street, Petersburg, S. Australia, Australia. This invention relates to a method of and means for the application or retraction of independent or hand brakes from either side of a railway-vehicle, the especial object being to enable the application or retraction of the brakes to be accomplished without any risk by a person walking along on either side of the train.

RETURN-TICKET-VOUCHER ENVELOP.—C. J. SWANK, Oakland, Kan. Mr. Swank's invention relates particularly to improvements in envelops for sealing vouchers designed as a means for securing the issue of a return-trip railway-ticket. The object of the improvement is to provide an envelop particularly adapted for incasing the voucher.

MAIL-POUCH ATTACHMENT.—W. D. MILLER, Saco, Mont. The purpose of the invention is to render more certain the catching of a mail-pouch by the arm of a moving train and the catching of the delivered pouch by the arm of the mail crane. With apparatus now ordinarily used, should the arm of the moving train strike the pouch at any point excepting approximately the middle thereof the arm fails to securely engage the pouch and the latter is frequently not caught by the train, and when thrown from the train it is jarred and contents often injured. The invention overcomes these disadvantages.

Pertaining to Vehicles.

TILTING ATTACHMENT FOR VEHICLE-TOPS.—D. W. LEONARD, near Hurn, Wash. In this instance the object is to provide an attachment for the foldable tops of vehicles that may be readily applied thereto and which affords convenient and reliable means for instantly raising or lowering the foldable top, and when the top is quickly lowered cushions its descent so as to prevent jar and injury to the prop-braces, bows, or other top parts.

TIRE-CLAMP.—P. F. SCHAFFER, Philadelphia, Pa. In this patent the invention consists in certain novel constructions and combinations of parts; and the object Mr. Schaffer has in view is to improve and simplify that particular type of tire-clamp used for securing pneumatic or solid tires on the felly of an ordinary vehicle-wheel.

Designs.

DESIGN FOR OIL-CLOTH.—A. B. BUCHANAN, Peekskill, N. Y. Mr. Buchanan has invented four new original designs for oil-cloth. The patterns are richly varied and form a pleasing ornamental departure from the styles now in vogue.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of the paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 5856.—For manufacturers of armor cloth or bullet-proof cloth.

AUTOS.—Duryea Power Co., Reading, Pa.

Inquiry No. 5857.—For manufacturers of aluminum signs.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 5858.—For manufacturers of tailors' cement for clothing.

Perforated Metals, Harrington & King Perforating Co., Chicago.

Inquiry No. 5859.—For manufacturers of corset laces.

FOR SALE.—Patents on collapsible umbrella. Box 1125, Omaha, Neb.

Inquiry No. 5860.—For manufacturers of match-making machinery.

If it is a paper tube we can supply it. Textile Tube Company, Fall River, Mass.

Inquiry No. 5861.—For the address of the manufacturers of the Clow hydrant.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 5862.—For makers of yard (not fire) hydrants with 1 and 2-inch inlets and outlets.

If you wish to buy patents on inventions or sell them, write Chas. A. Scott, 340 Cutler Building, Rochester, N. Y.

Inquiry No. 5863.—For makers of rubber stamp supplies and outfits.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery and tools. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 5864.—For makers of machinery for drying glue.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Machine Company Foot of East 138th Street, New York.

Inquiry No. 5865.—For a machine similar to a carpet sweeper for taking up the dust.

We manufacture anything in metal. Patented articles, metal stamping, dies, screw mach. work, etc., Metal Novelty Works, 43 Canal Street, Chicago.

Inquiry No. 5866.—For hand power or power washing boxes for extracting gold from sand.

Patented inventions of brass, bronze, composition or aluminum construction placed on market. Write to American Brass Foundry Co., Hyde Park, Mass.

Inquiry No. 5867.—For makers of cubeb or cinnamon cigarettes.

Inquiry No. 5868.—For makers of earthenware cuspidors.

Inquiry No. 5869.—For makers of artificial ice plants.

Inquiry No. 5870.—For makers of tattooing machines and supplies.

Inquiry No. 5871.—For the address of the "Niagara" Hydraulic Ram Manufacturing Company.

Inquiry No. 5872.—For manufacturers of steam turbine engines.

Inquiry No. 5873.—For manufacturers of sand blast machines such as are used in cleaning front of stone buildings.

Inquiry No. 5874.—For makers of buffers, or polishing wheels, for silverware.

Inquiry No. 5875.—For a machine for setting back the thread on wagon axles, when the wheel and shoulder have become worn and cause the wheel to rattle.

Inquiry No. 5876.—For the manufacturers of the "King" can opener with corkscrew.

Inquiry No. 5877.—For makers of luminous paint.

Inquiry No. 5878.—For the manufacturers of a dinner kettle that is heated by acetylene gas.

Inquiry No. 5879.—For the manufacturers of a flexible metallic mantle that is indestructible by the duty it has to perform when used for lighting purposes.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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Minerals sent for examination should be distinctly marked or labeled.

(9441) G. C. asks: 1. Is there any purely geometrical method for constructing a line equal to one-quarter a given circumference? A. A line equal to the quarter of a circumference cannot be exactly determined by geometrical methods. Approximately, the quarter circumference is equal to 0.7854 times the diameter. 2. What is the function of the globe on an open arc lamp? A. The globe on an open arc lamp is useful in catching the pieces of hot carbon which are frequently projected from the lamp, and which have been the cause of fires. It also prevents the wind from blowing the arc. 3. Why does a bicycle stand up more easily when moving than when still? A. A moving body tends to maintain the plane of its motion. For this reason a flat plate can be thrown and made to glide through the air a long distance, and a stone may be made to scale along the surface of water. A bicycle stands up while in motion for the same reason. The larger the wheel, the firmer it stands. Those who rode the old high wheels say that they were much more rigid against tipping over sideways than the lower wheels in use at the present time. 4. What would occur in the water column of a siphon if all atmospheric pressure were suddenly removed? A. If the pressure of the atmosphere were removed, water could not be raised in a siphon or a lifting suction pump. If a siphon were running and the air pressure were suddenly removed, the water would suddenly drop out of both legs, the stream breaking at the top and falling down both sides. 5. Does not a voltaic current consist of two opposite charges flowing in opposite directions in the same wire at the same time, just like the charges of a lightning stroke? A. No one knows in which direction the voltaic current flows through a wire. It may flow from what we call plus to minus, or in the opposite direction. It is a conventional matter to say that the current flows from plus to minus. It cannot flow both ways at once, since that would make the current similar to an alternating current. 6. Could a person deflect an appreciable portion of a street-car current by placing the ends of a thick copper wire at different points on a rail? If not, why? A. No appreciable portion of a street-car current would be deflected through a wire placed on different portions of a street-car rail, because the resistance of the wire would probably be greater than that of the rail between the ends of the wire. 7. If one should take a compound bar made of five metals of different conductivities for sound, and give it one tap upon the end, would he hear at the other end five separate taps? A. This question is indefinite. If a compound bar is made by putting five different metals together end to end, a blow given on one end would be transmitted through the bar, passing with different velocities through the several metals, and but one sound would be heard at the further end. If five several bars be placed side by side, and the ends of all be tapped at the same moment, the sound would travel through each with the proper velocity, and if the bars were long enough, these sounds would separate appreciably from each other, and be heard as separate sounds at the farther ends of the bars. 8. What is the highest ratio of weight to strength which can be obtained in an electro-magnet? A. The highest ratio of weight to strength in an electro-magnet is obtained when the iron is completely saturated with magnetism. The limit practically is reached when there are 140,000 lines of force per square inch of polar surface. If, however, by "strength" you mean lifting power, the practical limit is reached at about 150 pounds per square inch of polar surface. Though the lifting power may be increased beyond this amount, the cost of the strength is much in excess of the cost below saturation. The highest figure given by Thompson in his table is 230.8 pounds per square inch of polar surface. We presume considerable more has been lifted, but we have no data at hand above this point. 9. How does a locomotive gain tractive power by adding more drive-wheels, when according to physics the friction is independent of the amount of surface in contact? A. The "friction of bodies is directly proportioned to the pressure," is Morin's first law. What you have stated is the second law of friction. In designing locomotives, it is the weight on the wheels which governs the number of wheels by its limit, which is about 20,000 pounds on each driving wheel in the heaviest engines, and varies to as low as 7,000 pounds per driver. The addition of drive wheels to an engine without adding to its weight, or transferring the weight on the truck to the added wheels, does not add to the tractive power of the locomotive.

(9442) E. N. M. asks: Will you tell me how to make a permant steel magnet? I have been looking over your catalogue, and I find nothing that enlightens me on the subject? A. To obtain a good steel magnet, it is necessary in the first place that the steel shall be adapted to this purpose. High tool steel is usually specified for permanent magnets, but if it contain a certain percentage of manganese it cannot be used. Some grades of cast steel, mild plate steel, and spring steel take magnetism well, but do not retain it well. Some prefer Jessup's and others Stubs' steel. Select a close-grained rolled steel, heat it to a cherry red, and plunge it into water or oil. It will be tempered glass hard. If put in edgewise, it is less liable to be curved by unequal cooling. It is not necessary to temper the whole length of the bar. If the two ends are hard, the center may be left soft. It is easier to temper the whole at once. There are two modes of magnetizing a bar magnet. If you already have a strong magnet, you may draw it along the bar from end to end, pull it off, return in a curve to the place of beginning, and pass it along the bar many times. Do the same with the different sides of the bar. Ten to fifteen times on each side will be sufficient. If you have a dynamo or a good battery at hand, wind a coil of insulated copper wire with an opening large enough to allow the bar to be passed freely through the coil, and pass the bar to and fro from end to end several times while the current is flowing in the coil. For the current of a battery use No. 14 or No. 16 wire and 30 to 50 turns. For a dynamo current the same coil may be used, if the coil is put in series with a lamp. It will be made too hot by the current if put on short circuit.

NEW BOOKS, ETC.

DIE ELEKTRISCHE BÜHNEN UND EFFEKT-BELEUCHTUNG. By Dr. Th. Weil. Vienna and Leipsic: A. Hartleben's Verlag, 1904. 16mo.; pp. 256. Price $1.25.

The book deals with theatre stage illumination. The author has treated a very special branch of electricity in an admirable manner. The subject is of growing importance, and each new theatre is better than the last as regards the electrical installation. We can recommend this book.

AMERICAN METER PRACTICE. By Lyman C. Reed. New York: McGraw Publishing Company, 1903. 8vo.; pp. 196. Price $2.

This book will be found useful both to the central station manager and to the consumer of electricity. It describes the principles and methods of construction of typical American meters, and contains, among others, chapters on the "General Management of the Meter Department" and on "Reading Meters," chapters of value to the two classes of men above mentioned, respectively.

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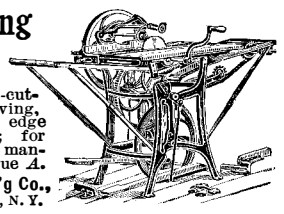

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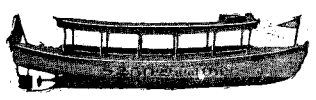

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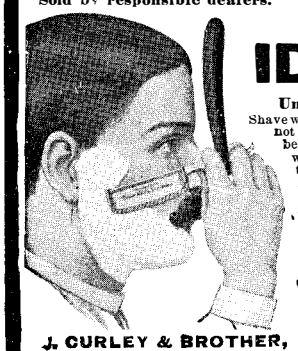

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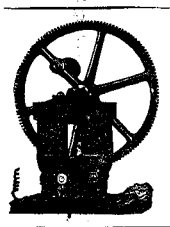

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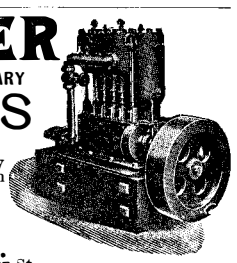

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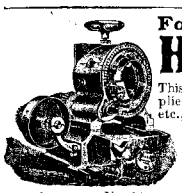

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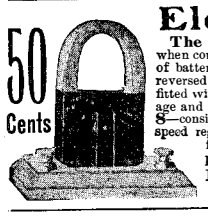

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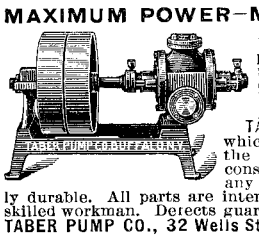

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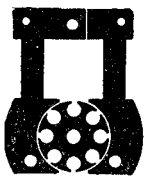

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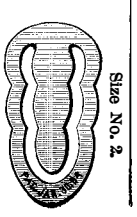

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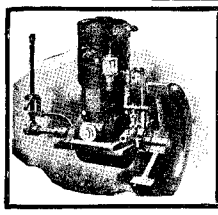

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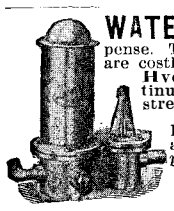

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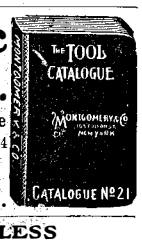

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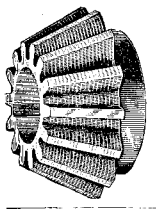

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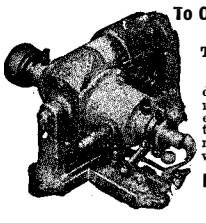

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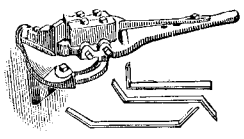

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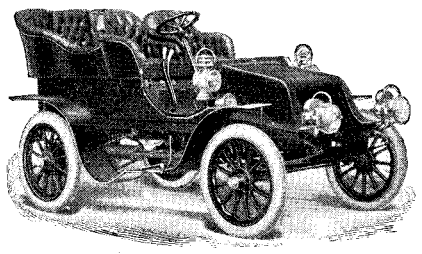

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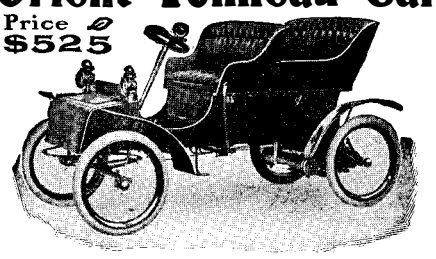

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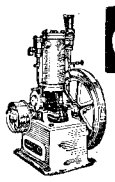

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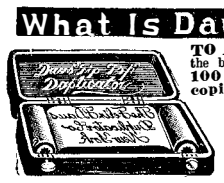

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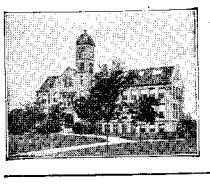

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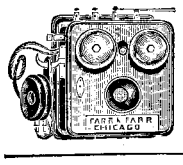

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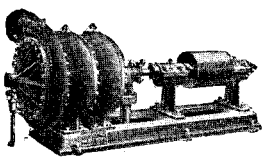

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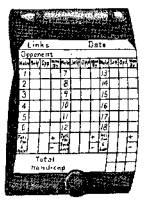

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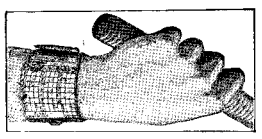

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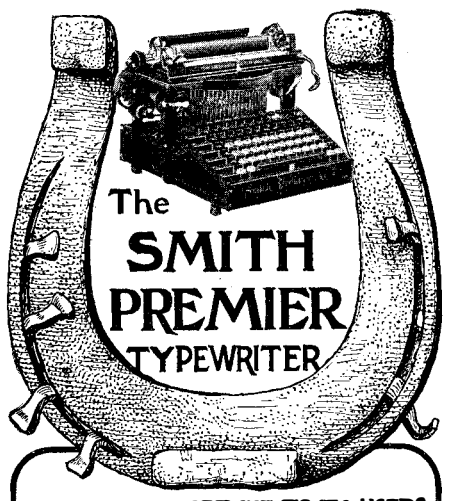

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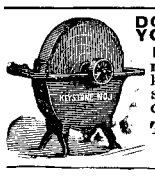

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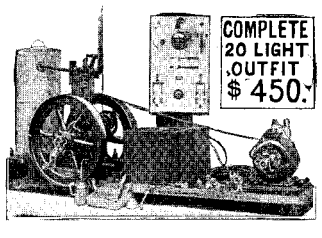

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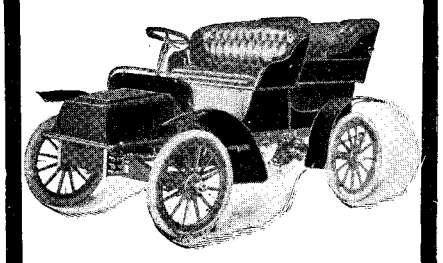

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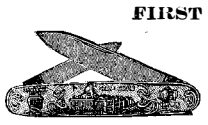

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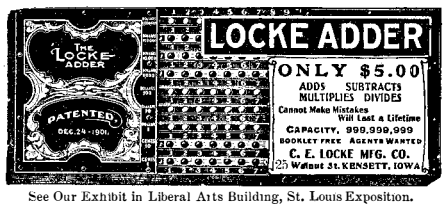

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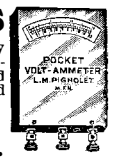

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